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On Communications

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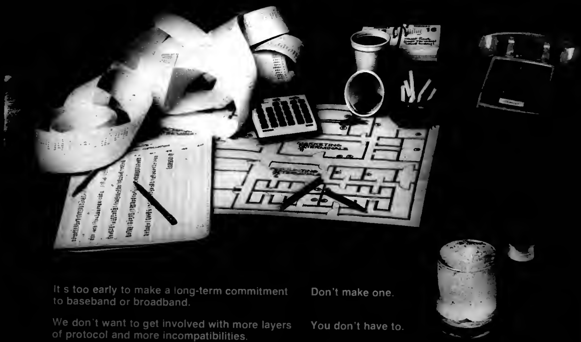

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On Communications

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The articles in this issue of *Computerworld On Communications* were compiled with the assistance of Ronald A. Frank, the managing director of Frank Communications Group, a telecommunications consulting firm in Mont Vernon, N.H.

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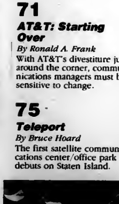

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William E. Grayson, Vice President Computer S
American Security Life Insurance C
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EDITORIAL

Future Shock?

Never in its history has the communications industry seen the upheaval that has characterized AT&T's divestiture, which is slated for completion on January 1. The end of communications regulation and the birth of a deregulated environment has altered forever the way Americans will communicate with each other at home and at work.

In the new age of competitive communications, business users must make themselves aware of how competition will affect their survival. No longer can they sit back and let the omnipotent telephone company do everything for them, make all the decisions. The Bell breakup has opened the door to a flood of competitive products and services.

Large and small companies that do not move quickly to take advantage of post-divestiture opportunities may find themselves at a competitive disadvantage with companies that do. Just as certainly as information has become a corporate resource, effective manipulation of that information is a prerequisite for survival and success.

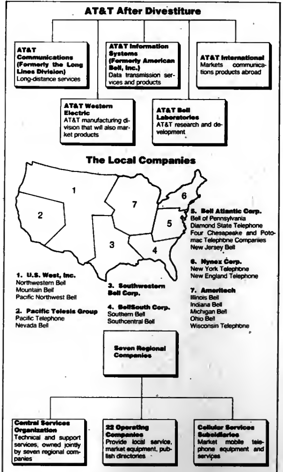
Business users should start — should already have started — scrutinizing their internal communications hierarchy. Who has managed the communications function in the past and how equipped is that person to move aggressively into the future? If the data and voice communications managers in larger companies have operated independently of each other, they should become acquainted quickly because the technologies they manage are merging.

In smaller companies, the crisis is just as real, perhaps more so. In companies where AT&T has been especially dominant, it is imperative that whoever is in charge of communications evaluate the wide range of available options. The helping hand of Ma Bell will soon be withdrawn and replaced by a multitude of competing and confusing offers.

Top management must act on these issues quickly. It must make decisions on technology areas outside its traditional business expertise. Communications managers should seize the initiative and intervene in the process by offering proposals and alternatives. By doing this, they stand to increase their overall importance to their companies dramatically.

Of course, none of that can happen if top management refuses to act. There will be plenty of political infighting in large companies as data communications, voice communications and data processing managers all vie to fill the void created by deregulation. If that battle is allowed to rage unchecked, nothing will be accomplished and the company will remain mired in its outdated communications strategy.

It doesn't make sense for these managers to clash. If they do, their image will be tarnished in the eyes of their superiors. If they band together and map out a clear strategy for top management, they will have demonstrated business acumen, which is likely to be remembered at promotion time.


AT&T After Divestiture
AT&T Communications (Formerly the Long Lines Division)
Long-distance services
AT&T Information Systems (Formerly American Bell, Inc.)
Data transmission services and products
AT&T International
Markets communications products abroad
AT&T Western Electric
AT&T manufacturing division that will also market products
AT&T Bell Laboratories
AT&T research and development
The Local Companies
1
2
3
4
5
6
7
1. U.S. West, Inc.
Northwestern Bell
Mountain Bell
Pacific Northwest Bell
2. Pacific Telesis Group
Pacific Telephone
Nevada Bell
3. Southwestern Bell Corp.
4. BellSouth Corp.
Southern Bell
Southcentral Bell
5. Bell Atlantic Corp.
Bell of Pennsylvania
Diamond State Telephone
Four Chesapeake and Potomac Telephone Companies
New Jersey Bell
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New York Telephone
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Seven Regional Companies
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22 Operating Companies
Provide local service, market equipment, publish directories
Cellular Services Subsidiaries
Market mobile telephone equipment and services

On January 1, 1984, AT&T and the local operating companies will be restructured. Managers must scrutinize their communications hierarchy in order to take advantage of post-divestiture opportunities.

After its initial two appearances in 1983, *Computerworld On Communications* will be published six times in 1984, a year in which we hope to present problems, solutions and personalities that are relevant to your communications world.

Going bimonthly gives *CWC* the opportunity to print more stories. It also increases our responsibility to serve the needs of readers. There are three ways that you can help us fulfill that responsibility:

- *Write a letter to the editor.* We welcome your opinions on every aspect of *CWC.* If you like or dislike an article, we want to know why. If you think we are ignoring something important, tell us what. Letters must be signed if they are to be printed.
- *Write a reader commentary.* Sometimes a letter just isn't enough. If you have a communications topic you'd like to discuss at more length, send us a commentary. It should be no longer than 1,000 words.
- *Send an offbeat or humorous anecdote.* Let's face it, there are a lot of weird things going on out there. Even though communications technology is extremely complex and subject to occasional failure, it seems that more often than not, the human touch is at the bottom of embarrassing problems. We would like you to describe your personal experiences in 250 words or less. Pictures are also welcome. Look for this regular feature on the last page of *CWC.*

All submissions should be typed and double-spaced. They may be edited for purposes of brevity, style and clarity.

Correspondence should be addressed to Editor, *Computerworld On Communications,* 375 Cochituate Road, P.O. Box 880, Framingham, Mass. 01701.

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DIALOGUE

How is your organization being affected by the reorganization of AT&T and what are you doing about it?

Anthony Donato, manager, data communications systems, European-American Bank & Trust, Westbury, N.Y.:

"As of now, it has had little effect because we are primarily on the data side, and we do not have responsibility for voice. I'm sure there are going to be major ramifications. We're looking to integrate voice and data functions, and we are going to be planning for that by making sure we keep abreast of what's going down.

"I see right now a need for us to reduce our reliance on Bell as much as possible. One of the things we've done is reverse our [private branch exchange (PBX)] decision. We were going to go with [AT&T Information Systems, Inc.'s] Dimension, and we backed off and went with the Rolm [Corp.] switch instead."

Orville Druckenmiller, director of corporate operations, management information systems, AMF, Inc., White Plains, N.Y.:

"The one element that we foresaw a long time ago was simply looking for alternative solutions. We embarked on a program four or five years ago to take out all AT&T equipment when it came to voice and concentrate on Rolm PBXs.

"We foresaw the potential of the digital switch even though we couldn't do much with it at the time — and we guessed right, I think."

Robert B. Brown, superintendent, communications systems division, Detroit Edison, Detroit:

"If we are going to minimize the impact of divestiture as we see it, we are going to have to have additional engineers and technicians to enable us to take advantage of some of the alternatives that will be available.

"We are really no strangers to a lot of the changes brought up by divestiture. We have several interconnect switches in service, and we have a sizable private microwave system. It's a matter of replacing existing electromechanical switches and centrex systems with on-premise modern switching vehicles and expanding our microwave system to take advantage of it."

Lois Hitzeman, supervisor, telephone operations, Ferris State College, Big Rapids, Mich.:

"We are interconnected with our own telephone system. We are using data through our computer center, but we are not going out on any kind of a data network as yet. So all we are doing is leasing our lines from the Bell people. We do all of our own maintenance and installation. At the present time, we are not being affected that much as far as the divestiture is concerned because we have our own equipment and our own maintenance personnel.

"As we go into local-area networks and resale, our contact will be closer with AT&T. Depending on their rates and whatever structure they come up with, we will be affected at that time. After the first of the year, we will know more what we're getting into."

Kerry Overlan, director, corporate telecommunications, United Brands Co., Boston:

"We're going to use divestiture to implement technology now that it is clear to both corporate management and telecommunications management that there is a variety of technology out there. The companies that are going to succeed are the companies that use it most effectively.

"For instance, let's take the PBX. It's clear to me that the PBX is going to be the vehicle through which one can not only handle telephone communications, but through which one can use technology such as phone mail.

"The telephone itself is moving toward data input terminals, and it will have limited personal computer capabilities. It will be the terminal in the office of the future, 25 years out. It will be gradually moving toward that, and that's the kind of strategy we are trying to implement."

Jim Taylor, project manager, payment-in-kind contracts, Plains Cotton Co-op Association, Lubbock, Texas:

"The impact is limited as far as we are concerned because the majority of our private-line billing and services went through AT&T to begin with, and we run an interstate network. We really haven't seen a real significant change as far as our operation is concerned — not yet.

"I expect to see significant increases in local rates, I expect to see longer time elements in getting repairs during outages, and I expect to see higher private-line costs. We will be using additional multiplexers and private-line services and in-house maintenance on our telephone equipment."

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Key:
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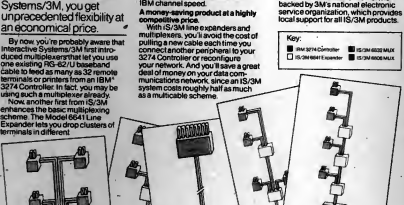
☐ IS/3M 6641 Expander
■ IS/3M 6632 MUX
■ IS/3M 6606 MUX



Model 6641 Line Expanders direct data from an IS/3M 6632 Multiplexer attached to the IBM 3274 Controller to one, two, three or four IS/3M 6600 Multiplexers that can be arranged in a variety of network configurations such as those shown here. These line expanders make it easier for as many as 32 terminals and/or printers to be served by a single RG-62/U baseband cable.

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GLOSSARY:

ASCII (American Standard Code for Information Interchange). The language spoken by most Personal Computers.
ASYNCHRONOUS Low speed, low-cost modems used with most Personal Computers.
BSC Some Personal Computers support, via existing programs, the BSC (Bisync) protocol. See PCI 71B/SNA for SNA-compatibility.
CoaxFACE™ Exclusive PCI converter allows you to drive Personal Computer using standard coax cable, without re-cabling with RS-232C.
FULL SCREEN The ability to modify an entire CRT screen of data without interruption of host.
MODEMS Provide terminal/CPU digital interface into an analog signal for the phone lines.

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3278/3287 IBM's CRT; IBM's printer.

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The PCI 1076 gives you tremendous flexibility for those locations with PCs.

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ASSAULT ON THE 3270: NOW THERE ARE CHOICES

BY SCOTT BREAR

With an installed base of more than one million units, IBM 3270 controller and terminal systems are hardly newcomers to the computer industry. Nevertheless, this market is growing more rapidly than ever, continuing to offer more technological variety and product choice for lower prices.

Part of the impetus behind this surge comes from IBM itself. The 3270 market has been dramatically revitalized by IBM's introduction of the Personal Computer and its rapid move into a leadership position among microcomputers. Viewed by many users as a powerful and necessary liberating force, the Personal Computer, along with its popular competitors from Apple Computer, Inc. and Commodore Business Machines, Inc., has moved uninvited into the corporate data processing scheme.

When employees decided they needed ▶

to access and own personal data bases, the DP manager lost his valuable system, typically built around the 3270, of uniform, flexible information exchange. Differences in format, applications and styles created major disruptions in large DP operations.

Currently, IBM is sitting on both sides of the fence: It has an extremely successful line of personal computers, but it also has a vast investment in the more traditional 3270 data communications systems. How can these be brought together?

LEFT TO ITS own devices, IBM might have ignored this dilemma for some time. But many plug- and system-compatible vendors were not in a position to wait. They quickly jumped into the fray, offering a number of approaches to bridge the gap between micro users and DP environments.

Corporate users quickly realized that personal computers were not the panacea they had expected. Even though micros could perform many minor tasks, they had no access to the vast amount of information stored in the host.

The recent rash of 3270 announcements has addressed ways of combining the freedom of personal computing with the requirements of a host system and the cost-effectiveness of networking.

The 3270-compatible manufacturers are faced with a basic design challenge. Most 3270-type terminals are networked via coaxial cable. While many advances in coaxial technology have been made, they have not addressed the problem of meshing 3270 and personal computer capabilities. Most personal computers do not have the coaxial connector for hookup needed to obtain direct access to the IBM host's information.

Current product offerings indicate two strategies for bringing personal computing to 3270 systems: bolt-on and controller-based methods. The bolt-on method entails connecting a new device either to an existing personal computer or a 3270-type terminal. Most manufacturers, including IBM, have chosen this approach.

IBM's recently introduced products include an option that allows the 3278 terminal to operate as a personal computer, the Personal Computer XT with greater memory and several display stations.

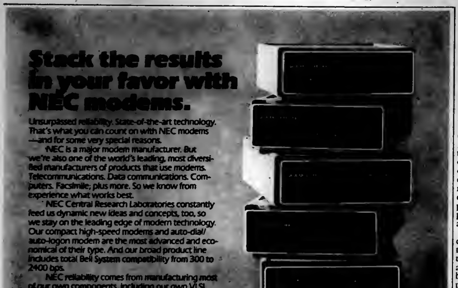
Similar approaches from other companies include 3270 conversion boxes that allow different makes of personal computers to operate as data communications terminals in corporate networks. This method typically involves placing a dedicated 8-bit processor and floppy disk at each CRT terminal.

The basic premise underlying these products is to allow users to switch between personal computing and 3270 capabilities. The bolt-on approach solves part of the problem — that is, having only one terminal on a user's desk instead of two — but it does not address one of the major requirements of the 3270 market: economy of scale.

A typical 3270 system includes a 3270-type cluster controller and 12 terminals. Needless to say, users of such systems are committed to large-scale computing. Bolting a box onto each terminal solves immediate problems, but exposes DP managers to other potential problems as well as high costs. For example, multiple bolt-on personal computer configurations require corresponding multiple hard disk drives, printers and software packages.

A solution diametrically opposed to this is to attack the problem in the controller itself with a built-in solution. By placing computing power and memory inside a controller, terminals can play either a personal computer or 3270 role and, through networking, share peripheral devices.

The most obvious benefit is that instead of buying a conversion box for each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terminal, users can buy one or more controllers, access several IBM hosts and attach a larger number of devices. In some cases, as many as 120 devices can be attached, with up to 32 working as personal computers simultaneously.

With a few keystrokes, a user can order his terminal to operate as a personal computer, creating programs and personal data files while accessing the host and sharing data with others in the network.

Another benefit of this built-in controller-centered method is software savings. Rather than buying a software license for every workstation, an organization only needs to purchase one license for the controller. The cost is then split among the displays.

While personal computing has given a new emphasis to the 3270 environment, a number of related advancements regarding speed and distance bear mentioning.

DISPLAYS AND printers were originally connected to the controller via coaxial cable in a star configuration — one device per cable. However, the obvious high cost of cable and the potential unreliability of this setup presented problems. A method first introduced 10 years ago, but only now becoming standard, is multiplexing on a single cable. Instead of one cable per CRT terminal, a single cable links all the displays. Eliminating coaxial cable is an important, easy way to save money.

The number of tubes connected to a controller is also increasing. Up to now, 32 was standard. If more were needed, the customer had to invest in an entirely new system. But vendors are beginning to address this problem. The Braegen Corp., for example, recently unveiled a system that allows 60 drops per cable, with two cables per controller. In addition, for a virtually fail-safe operation, up to four controllers can be connected on a single cost-effective coaxial link. If one controller goes down, the others can fill in. Security and flexibility are assured because each CRT terminal has dozens of combinations of devices to address.

And new technology in both coaxial protocol and controller design eliminate the once-common speed and throughput problems.

Used as an alternative to 3270 coaxial connection, twisted-pair networks implemented via RS-422 or RS-232 interfaces are limited by slower data transmission speeds, but retain an important advantage. Because twisted-pair is already in place in many buildings, system installation costs can be low. Unlike coaxial configurations, twisted-pair configurations allow for modem connections.

Another cost-saving trend is the increased maximum distance between controllers and terminals. Users do not have to be in the same room, much less the same building, as the host. Cables between devices are extending further and further — a big plus for large companies. The maximum unrepeated distance between controller and tubes is currently 7,500 feet, and it will soon jump to 10,000 feet.

A change in the protocol — or the rules behind synchronous communications that run the 3270 environment — is also in the works. The IBM Binary Synchronous Communications, introduced in the mid-'60s, is still used in nearly 75% of all 3270 systems. It may be all that most users require for a long time. However, as is typical, manufacturers and users want to pursue the newest technologies available.

Many users are demanding that new 3270 equipment installations run under IBM's Systems Network Architecture (SNA), which uses the Synchronous Data Link Control. With IBM heavily backing this technology, SNA should become the dominant 3270 protocol.

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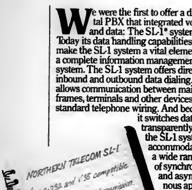
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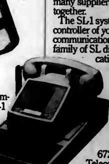

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networks will become more acceptable to 3270 users over the next few years as packet assembler/disassembler (PAD) devices come into widespread use. Although packet-switching networks are inherently more reliable than dedicated point-to-point links, their pricing and performance have prevented them from fitting in with the polling operating characteristics of 3270-type terminal clusters.

Up until now, this has kept such networks the exclusive domain of asynchronous terminals. However, PAD devices should allow users to accommodate their 3270-type terminal systems to these X.25 network anomolies.

Speed, cost and reliability are important. But what the average 3270 user sees and feels is almost as significant. That is where one of today's most overworked words, ergonomics, comes into play.

Several concepts designed to enhance the user's 3270 experience revolve around the CRT terminal. Screens were originally 15 inches in diameter, bulky and had integral keyboards. Now, a 12-inch screen is becoming more acceptable, and detachable keyboards can rest on the user's lap up to 10 feet from the terminal. Low-profile keyboards that meet the German Standard Organization's standards satisfy the requirement for modern equipment.

Flat-panel display technology is another important improvement. IBM's 3290 plasma display, one of the newest entries in this market, offers several advantages. It eliminates the CRT user's frequent, though unsubstantiated worry about possible radiation danger. In addition, it consumes approximately one-fifth the power of other CRT displays. The only problem is price: Plasma displays currently cost four to five times more than other displays.

Another change to watch for is the reversal of screen images. Negative screen images, light letters on dark screens, are currently in use. In the next few years, with increased CRT scan rates, it will be possible to have dark letters on light backgrounds, without the jittery characters that have plagued previous attempts.

ONE DEVICE within the 3270 environment that has improved and will continue to do so is the printer. Soon, the market will see a deluge of letter-quality dot-matrix printers, laser printers, line printers and screen printers connected to CRT terminals. Printing costs will be lower than ever, not only because of the more widespread design technology, but because of the ability to link more CRT terminals and shared peripherals.

Despite, or perhaps because of, these various technological developments, users are now facing a rapidly changing 3270 marketplace. IBM's famous "price umbrella," which allowed competitors to sell products strictly based on lower cost, no longer exists. In a much more aggressive posture than has been typical, IBM recently slashed product prices. With this new price structure, consumers are becoming more conscious of product quality and additional services.

A supplier shakeout in the 3270 market, possibly involving some of the larger, more traditional companies, can be predicted. In order to stay alive and prosper in this billion-dollar industry, participants need new technology, excellent services and quality features.

Unlike other systems, the 3270 will not be totally displaced by newer, different technology. Enhancements and modifications will emerge, but they will be based on the existing product base. Thus, the consumer's initial investment in a 3270 system is well-protected and well-suited for economic modernization. ■

Brear is director of product marketing with Braegen Corp., Milpitas, Calif.

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FUTURE NETWORKING WITH IBM

Once upon a time, back in the heyday of punch cards and magnetic tape, International Business Machines Corp. was a data processing and office equipment vendor. Period. But things have changed since the late '60s, and now IBM is seen as a trendsetter in communications for the '80s.

Communications has become a major strategic area at IBM. Based on its own forecasts of what users will need in the future — even before those users understand their requirements — IBM management has committed a large share of research and development funds to communications technology and products. IBM planners realize that, so far, most computing power has ▶

BY JOHN KING

ILLUSTRATION BY HAYES KELLEY, CAMERON INC

been used to solve large numerical problems or to support major clerical or bookkeeping functions. Except for computer programmers, few professionals, managers and executives have directly benefited from the application of computer power to their tasks. The largest and most sophisticated data communications networks have primarily supported only clerical and administrative functions.

> ***Sometimes current or future problems are the result of former practices or emphasis on different problems. For example, the shift to desktop computing and local-area networks for peer-level communications is difficult for IBM.***

It is easier to understand IBM's future by noting a trend that has been established over a number of years. In the beginning, there was the System Communications Division. In October 1981, IBM announced a reorganization plan, creating the the Information Systems and Communications Group with three divisions responsible for all smaller IBM products. The divisions are the System Products Division, the Information Products Division and the Communications Products Division.

Within the past few months, IBM has further updated the organization of the group with the creation of the Entry Systems Division. This division is responsible for the IBM Personal Computer and all other desktop computer systems in the IBM product line.

IBM started with a large system mini-set, then embraced distributed processing and now espouses fully distributed desktop processing.

Sometimes current or future problems are the result of former practices or emphasis on different problems. For example, the shift to desktop computing and local-area networks for peer-level communications is difficult for IBM. The assumptions underlying the original development and subsequent implementations of Systems Network Architecture (SNA) consistently involve large computers at one end of the communications link and terminals at the other end. It is difficult, time-consuming and expensive to merge the two and bring peer-level communications between personal computers into the SNA scheme.

On the other hand, IBM is able to move quickly when it is not constrained by prior products and strategies. Slow movement — such as in the introduction of a new local-area network and the extension of SNA to include the local net capability — is due to IBM's success in the past. Without this success, there would not have been large investments and a large installed base of existing products.

The Personal Computer is changing this situation far faster than IBM had planned. The success of the Personal Computer certainly surprised IBM planners and managers. With personal computers, computer support bears directly on the tasks performed by professionals and managers. Micros increase personal productivity by allowing people to work faster, easier and more effectively. In addition, it has been demonstrated that linking several personal computers within a department or division of an organization can increase productivity even further through the sharing of resources and ease of communications.

Linking people and systems with communications networks has become just as important to users — and to IBM — as the individual pieces of hardware and software. SNA and its extension into local-area networks is more important to IBM than initially envisioned.

But, SNA and local-area networks are only two of the five key ingredients in IBM's communications strategy. The others are the private branch exchange (PBX) as a single point of communications control within an organization; fully distributed processing down to the desktop level, including a new role for the 8100; and new high-level architectures on top of SNA to standardize communications among many diverse software products.

SNA began as a cost-reduction effort for IBM. If IBM could reduce the number of software systems supporting data communications — there were an estimated 33 separate data communications access methods — then it would be able to reduce its costs for maintenance and support. If there

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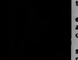

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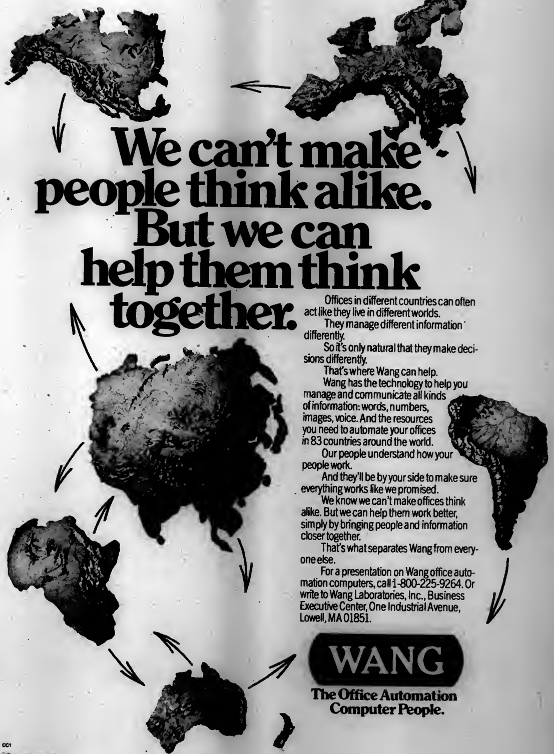

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was only one software system to support, then it would be practical to enhance that system to meet the growing communications needs of the '70s and, probably, the '80s.

Even before SNA was announced, IBM demonstrated its potential importance by assigning demonstrated achievers to the effort. The first president of IBM's System Communications Division was Bob Evans, who directed the System 360 development project in the early '60s. In addition, the chief architect for the new single communications network architecture was Ed Sussenguth, who also worked on the System 360 architecture.

The acceptance of SNA by major IBM customers was a slow process, which is still continuing 10 years after its announcement. One reason is inertia. Users who already have a major investment in a communications system are not likely to convert to a totally new communications architecture without being able to realize major price or performance benefits quickly. Initially, SNA offered few benefits.

Another reason is that non-IBM developments in packet switching, distributed processing, network management and local-area networks have proceeded faster than IBM can keep up with enhancements to SNA.

Nevertheless, the SNA evolution is not slowing down. In fact, it is picking up speed. As a result, approximately half of the users of large and medium-size IBM computers now have SNA networks installed. Despite the advances of other architectures, IBM users believe that SNA is the best solution in an environment dominated by IBM hardware and software.

IBM has also discovered another fascinating aspect of SNA. Because IBM can continue to enhance SNA after a customer converts to it, the customer is not likely to abandon it in the foreseeable future. This, tied in with mandating the use of SNA as a wide-area network standard for IBM products, has turned SNA into glue. It holds a system together.

Certainly, IBM would like to sell all of the equipment attached to SNA networks. But since IBM realizes that this is impossible, it is primarily concerned that the customer use SNA and not a competing architecture. Therefore, IBM no longer disapproves of competing vendors trying to attach their products to SNA networks. While it does not go out of its way to help vendors develop SNA-compatible products, IBM no longer actively blocks such development plans. The SNA user is by definition a major IBM customer.

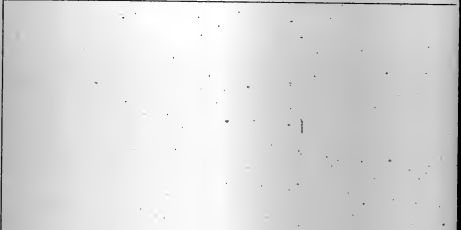
The biggest need today is for SNA to support peer-to-peer communications. It does not make sense for users of Personal Computers and other small systems who need to send data from one system to another to be required to send the data first to a large IBM host computer and then to the second small system. That is how it is still done, however, for reasons that lie in SNA's past — when the IBM world was dominated by large computers with a few dumb terminals.

> ***The SNA evolution is not slowing down. In fact, it is picking up speed. Despite the advances of other architectures, IBM users believe that SNA is the best solution in an environment dominated by IBM hardware and software.***

Network management is another major area in which SNA is being improved. IBM's concept of network management is different from that of the modem/multiplexer vendors that supply network management systems. These separate systems operate outside of the SNA scheme and are primarily involved in monitoring, analyzing and correcting problems on the communications circuit.

IBM's concept of network management goes far beyond the communications circuit. The SNA network management tools run in the host computer and are — or will be — capable of diagnosing problems in the hardware and software of remote systems. Recently, IBM has shown a complete network control system console, indicating that IBM will include circuit analysis in its end-to-end network management capability.

The most interesting aspect of the 3725 communications controller announcement was what it did not include. As SNA networks grow and as additional large processors are added onto them, the



demand for high-speed transmission paths grows rapidly. T-1 speeds and greater are needed, particularly for satellite communications. However, since the 3705 is still profitable, IBM wants to control its replacement. As a result, upgrades to the 3725, such as the addition of a T-1 interface, will be released over an extended period of time.

While SNA is the dominant network architecture in IBM environments, there are still many situations in which SNA is not used. This situation may arise in networks with a majority of non-IBM computers or when public data networks are available and leased communications circuits are not. In these situations, the X.25 network interface has been established as an industry standard.

In such cases, IBM may not be able to control the network, but does not want to be precluded from selling computers and terminals. The result is that SNA is continually being enhanced to have better X.25 interfacing capability.

IBM anticipates that in the next ten years, all information workers will be working with a terminal or workstation. But there is already a communications device that each of these workers uses: the telephone. In most medium-size and large organizations, telephones are tied together both within and outside the organization via a PBX. Can that same PBX be used to tie together all forms of communications, and not just voice? The answer is yes, particularly if it is a high-capacity, all-digital switch.

In most medium-size and large firms, telephones are tied together both within and outside the organization via a PBX. Can that same PBX be used to tie together all forms of communications, and not just voice? The answer is yes.

Until the advent of the personal computer, AT&T derived twice as much business from American industry as IBM. A large part of that revenue came from the sale or rental of PBXs, internal wiring and telephone instruments. IBM would definitely like to get a sizable share of that market. However, by establishing affiliations with PBX vendors and by setting industry standards, IBM will be in a position to control all communications within an organization. With Satellite Business Systems being a partly IBM-owned company, IBM can also garner a share of long-distance revenue from large businesses and government organizations.

User support is a critical issue in the integration of voice and data through a single PBX. Several vendors have announced the capability to support terminals and other data communications through PBXs. Often, the terminals can be attached directly to the telephones on workers' desks. For specialized interfaces such as the coaxial cable on the 3270 family, however, there are potential finger-pointing problems when the terminal does not work. In June 1983, IBM announced that it would acquire a 15% interest in Rolm Corp. Rolm was interested in working with IBM to solve the user support problem. It is in the best interest of the user, the PBX vendor and the data equipment vendor to settle support issues before such capability is installed.

As new interfaces are developed and marketed, particularly for local-area network systems, it becomes increasingly important for users to be able to use the installed switch to extend these local-area networks. If wiring that is already installed can be used with the upper-layer protocols from a variety of local network architectures including Xerox Corp.'s Ethernet, then users will be encouraged to expand use of office automation equipment more quickly. Any market that is expanding quickly is a good market for IBM.

The IBM investment in Rolm has significant implications on the market. With the division of AT&T into independent operating companies and the confusion over whether the installed customer premises equipment will become assets of the operating companies or AT&T Informations Systems, Inc. (formerly American Bell, Inc.), it is possible that Rolm will be the largest single PBX vendor. What better way is there for IBM to acquire market share rapidly than to invest in and cooperate with the largest vendor in a huge market?

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distributed processing. But now that the distribution of processing has gone all the way to the end user's desktop, IBM is suddenly in a position to become one of leading distributed processing vendors.

When distributed data processing (DDP) was beginning to take hold in the marketplace in the '60s and early 70s, IBM tried to ignore it. It emphasized large CPUs and systems such as SNA built around them. IBM's belated entry into the minicomputer market with the Series/1 was not intended to be a move into distributed processing. IBM's tentative movement toward DDP was highlighted by the 8100. This unit was never intended to be a full application processor: It was intended to work with host computer systems as an intelligent controller for terminals. As the divisions in the old IBM organization fought for market turf, the Systems Communications Division was forced to push the 8100 to do things for which it was not designed. Fortunately for IBM, other products led the way as the DDP market changed drastically.

The System/34 was intended to be a small business computer, but it also enjoyed considerable success as a distributed processor for companies with small autonomous divisions or offices. However, there was nothing that could have shocked IBM more than the tremendous success of the Personal Computer. IBM's micro, along with its competition from Apple Computer, Inc., Tandy Corp. and others, has given a whole new meaning to DDP. Processing power has migrated directly to the desktop.

These machines — which originally cost less than IBM 3270 displays — are capable of performing a wide variety of functions, including text processing, graphics and local data base management. They can also function as terminals. IBM believed that office workers would have terminals on their desks by the early '90s. No one anticipated a Personal Computer on every desktop.

The real challenge involves tying these desktop machines together so that groups of people and whole organizations can improve performance. Local-area networks become the key, whether they are coaxial cable-based, a new token passing ring using coaxial cable or twisted pair, or PBX-based.

THE SUCCESS of the Personal Computer has shown IBM that desktop computing is just as important as mainframe computing. IBM has several desktop computers on the market, including the Displaywriter, System/23 Datamaster, the 5520 and the 5280. IBM can be expected to expand its product line in this competitive market.

Expect to see three or four models of the Personal Computer on the market next year. IBM is pleased that the Personal Computer has become an industry standard, but it does not want it to be a static target that could be attacked in the marketplace if not continually upgraded.

In addition to the success of the Personal Computer and the expected new local-area network, the 8100 will get a new lease on life. In a way, it will be what it was originally intended to be — a super controller. However, instead of becoming a controller for dumb terminals, it will be a combined file server, print server and communications gateway for desktop computers connected by local-area networks. The recently announced cost-reduced models of the 8100 indicate that IBM is positioning the product this way in the marketplace.

Amidst all the discussion of IBM's new token passing ring local-area networks, it is often overlooked that IBM has a number of local-area network products on the market. These include the 3270 system with star configured coaxial cable, the twin-axial interface on the

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To give you [illegible] and cost savings, we've in-[illegible] our data [illegible] from two to four ports. Our [illegible] Port Data [illegible] compatible with most current [illegible]

ncreased data cap

ve have all kinds of computers– ow can I get them to communicate hrough the switch without a lot of xpensive hardware?”

Our new **Computer to PBX Interface** will allow many different makes and types of computers to communicate through the SL-1* digital system without modems or add-on data modules. This simplified interface means reduced cost of linking computer and PBX.

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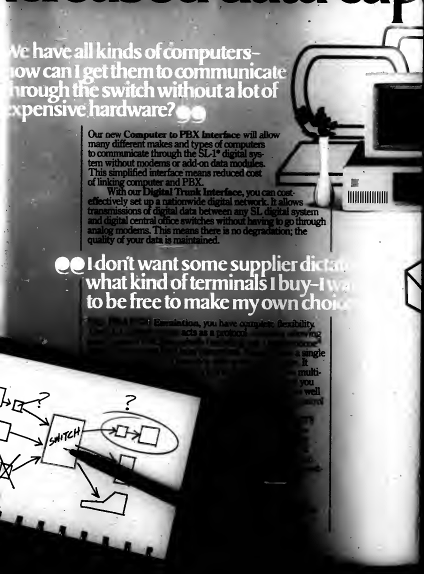

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The OPEN World

☑ **Continuity.** The system should evolve to meet new needs and accommodate new technology—avoiding obsolescence.

☑ **Compatibility.** It should allow many makes and types of equipment to work together in harmony.

☑ **Congeniality.** Systems and equipment should be attractive and easy to use.

☑ **Control.** The user should determine the structure and control the operation of the system.

☑ **Cost-effectiveness.** The system should produce measurable benefits at the bottom line.

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“Now I know that tomorrow is covered. Thanks to the SL digital system.”

System/34s and System/38s, the ringnet for the Series/1 and the loops for the 8100 and the 3600/4700.

IBM's challenge is to develop a local net architecture that will satisfy a wide number of market requirements. Acceptance in the marketplace would be slow if IBM simply supported the Personal Computer with the 8100 or limited local-area network support to future products. It would be a repeat of the long acceptance period for SNA.

If IBM is going to continue to sell a range of processors, it must develop a way for them to work together. This involves more than just hooking them together with a particular kind of wire. It is also necessary to ensure that they are able to send information from any system to another system when they are hooked into the same network.

This is difficult because the software systems were developed independently for IBM's various small system products, and the only thing they have in common is 3270 emulation. In the long run, assigning programmers to develop file transfer or message transfer programs for each computer system would cause even more confusion.

A set of rules for implementing intersystem communications is needed. SNA provides the rules for the transport of data through a communications network, and there will be new architectures for defining data formats and the control of data movement.

IBM is developing two new sets of rules, Document Interchange Architecture (DIA) and Document Content Architecture (DCA). They will provide standards for all software written for intersystem communications.

DIA is an architecture for storing, retrieving and moving information from one system to another. It provides a simple set of commands for users who enter commands through a keyboard or programmers who put the commands directly into software. The idea is to have the same set of commands implemented in all of IBM's systems.

DCA provides a standardized method for defining data and various formats. For example, text that has been entered on the Displaywriter to be updated later is retained in a revisable form. Unfortunately, that revisable format is different from the one used by Micropro International Corp.'s Wordstar on the Personal Computer or by the IBM Professional Office System on the VM system. By defining a standard architecture and making all future implementations conform to that architecture, IBM will provide for easy movement of data from one system to another.

Even though DIA and DCA have not been published as proposed standards, preliminary documentation on them has been provided to the European Computer Manufacturers Association's standards committee for consideration.

> ***The challenge is to develop a local net architecture that will satisfy a wide number of market requirements. If IBM is going to continue to sell a range of processors, it must develop a way for them to work together. This involves more than just hooking them together with a particular kind of wire.***

In addition, IBM has been using DIA and DCA in some of its products: the Displaywriter, 5520 and Distributed Office Support System/Distributed Office Support Facility (Disoss/DOSF). Therefore, it is not an accident that all of these systems can already be linked together in a local environment with the 8100 running the DOSF software.

IBM's main thrusts in the communications environment are the extension of SNA to meet a changing set of user needs, the possible inclusion of voice communications along with centralized control through a PBX, the rapid extension of its presence in the distributed processing environment and the introduction of a standardized method to allow different systems to operate together. IBM is both expanding its markets and providing tools to allow those same markets to expand even more rapidly in the future. That sounds like a marketeer's dream come true. ■

King is vice-president for strategic planning projects, the DMW Group, Inc., Carmel, Calif.

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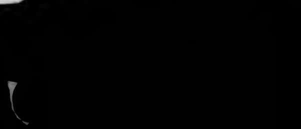
LINKING COMMUNICATIONS TECHNOLOGIES

McGOWAN & MCI

Just before speaking to a group of communications analysts in New York last June, Bill McGowan was asked for his thoughts on Pacific Telephone and Telegraph Co. Of all the seven regional companies slated to be spun off from AT&T in January, Pacific, which has since been renamed Pacific Telesis Group, is perhaps in the most precarious financial state.

McGowan, the gravelly voiced chairman of MCI Communications Corp., paused ▶

BY BILL LABERIS



GWENDOLYN STEWART PHOTOS

Fiscal Year	Revenues	Profit
1978	$74 million	$5.2 million
1979	$95 million	$7 million
1980	$144 million	$13 million
1981	$234 million	$21 million
1982	$506 million	$86.5 million
1983	$1.07 billion	$171 million

Figure 1. MCI's Sales Record

for a moment and took a drag from one of the cigarettes he chain-smokes. "If their stock goes down far enough," he said, grinning, "I'll buy them."

There was a time when not many people took the swaggering McGowan and his upstart company, MCI, very seriously. Barely a decade ago, he single-handedly took on AT&T, the business world's most formidable monopoly, challenging a structure that most people considered invulnerable. McGowan and MCI were not given a chance of winning.

But no one laughed in June when McGowan talked about taking on AT&T or any of its divisions — no one except McGowan. No one snickers when MCI boasts that it will double its billion dollar-plus sales in each of the next five years. No one, especially the brass at AT&T, jokes when MCI insists on the enforcement of deregulatory statutes that seem made to order for MCI. The company may have only 3% of the long-distance market compared with AT&T's 95%, but it is coming on strong.

"The whole story behind what MCI has accomplished and the odds it bucked is amazing," Stewart Bennett, a communications analyst with Walker-Davis Co. in New York, said. "The most amazing thing is yet to happen, and that's the leadership position the company will assume over the next five years. The lock is off the cupboard, and they're hungry as hell."

MCI began as Microwave Communications, Inc., a short-haul radio communications company that McGowan bought from John Goeken, its owner, in 1969. At that time, the company was trying to build a microwave-based, mobile radio network between St. Louis and Chicago, and AT&T was opposing the construction.

McGowan continued Goeken's effort and applied for microwave network licenses for 18 regional companies. The idea was to plant the seeds of a national network, and AT&T's vigorous opposition was predictable, according to McGowan.

BUT BY THE early '70s, McGowan had received Federal Communications Commission (FCC) approval for all the network licenses he had applied for, and he gathered the regional companies under the MCI umbrella. Instead of seeking the millions of small customers in the AT&T fold, MCI sought big-volume users. Later in court, McGowan contended that AT&T countered MCI's move with predatory pricing practices on selected long-distance lines.

McGowan, who had moved MCI's main office to Washington, D.C., began visiting key members of Congress and the Justice Department, armed with what he claimed was proof of AT&T's antitrust violations.

In a recent interview in his downtown office, he said that in 1973 he visited the late Sen. Philip Hart (D-Mich.), then head of the Senate Judiciary Committee. He presented Hart with a plan to break up AT&T, separating the local and long-distance components of the business in the interest of fair competition.

"Hart told me that I was

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1923 The first automatic exchange based on Ericsson's 500-switch system is installed.

1949 Company begins experiments with microwave systems. Radar manufacturing begins.

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1971 World's first computer-controlled telephone exchange is delivered by Ericsson.

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1980 Ericsson introduces the ASB100 and ASB900 PABXs to the United States. Datasaab becomes part of Ericsson, increasing capabilities in computer technology and data processing, along with special expertise in ergonomics.

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1983 Ericsson introduces Erix, an electronic telephone that enhances ASB100 and ASB900 performance, the Alfaskop multi-function computer system, the MD110 digital voice/data switch and the financial terminal System 2100.

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crazy, that such a thing would never happen because it was politically impossible," McGowan said. "He also said a divestiture like that did not make sense on any grounds."

McGowan left Hart's office and marched to the Justice Department, unloading what he claimed was concrete evidence of AT&T's illegal activities. The attorneys there listened and, in November 1973, issued a civil investigative directive, a formal probe of the matter.

FOUR MONTHS LATER, in March 1974, MCI filed its antitrust suit in U.S. District Court in Chicago, charging AT&T and its operating companies with monopolization in violation of the Sherman Antitrust Act. Six months later, the federal government filed suit against AT&T, charging abuse of monopoly power.

McGowan's battle against AT&T continued for another eight years before a federal judge ruled in MCI's favor and ordered the divestiture of the country's largest monopoly.

When did McGowan become convinced MCI would win? According to McGowan, this happened when he obtained the handwritten minutes of a meeting of the operating company presidents held at the Ocean Reef Club in Key West, Fla. The notes, taken by an AT&T vice-president, "assured the outcome, even though I knew it would be a long struggle," McGowan said.

According to McGowan, the discussion at the meeting centered around the the FCC's 1971 specialized common carrier decision, granting long-distance competitors of AT&T greater flexibility in building their networks.

"One of them said of MCI, 'Why don't we get rid of the bastards now before the government gets used to having them around?' " McGowan said.

"Then at a different meeting in Oregon, another said, 'We at the Bell System have decided we are no longer going to accommodate ourselves to government decisions we disagree with,' " MCI's chairman said.

"I realized then we were going to win, because the stupidest thing you can do in this country is to be arrogant," McGowan continued.

"It works for a while, but arrogance will assure your downfall, because our system will not tolerate it. In my case, arrogance, AT&T's arrogance, was my best friend," he said.

MCI's suit against AT&T resulted in a jury awarding the company an unprecedented $1.8 billion, which was appealed by AT&T. Last January, the U.S. Circuit Court of Appeals upheld the lower court's verdict, but ordered the district court to reconsider the $1.8 billion award.

MCI is undoubtedly battling long odds in taking on AT&T. The eventual outcome is still clouded by an uncertain regulatory future, but it looks as though MCI will be highly competitive next January 1, when AT&T's divestiture takes place. In fact, MCI has doubled its sales each year since 1980 (see Figure 1).

MCI has also dramatically increased its number of long-distance customers, jumping from 8,000 in 1978 to 1½ million today (see Figure 2).

But how long can MCI continue to double its yearly sales? Will a company with eight of its nine regional managers under the age of 40 be able to meet the challenges of prodigious growth that may end up to be unparalleled in the annals of American business history?

Number of Long-Distance Customers, Business & Residential Combined

Fiscal Year	Customers
1978	8,000
1979	15,000
1980	30,000
1981	250,000
1982	880,000
1983	1,250,000

Figure 2. MCI's Customer Base

Will MCI's communications network, now serving about 1½ million long-distance customers, expand to meet expected demand without compromising quality, especially as it gets itself ready for data communications and as it gears itself up for enhanced services?

McGowan answers all of those questions with a firm "yes." He explained, "My style's perfect for

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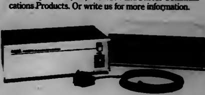

7001 PROTOCOL CONVERTER— enables synchronous transmission of data between hosts and asynchronous terminals.

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6300 STAT MUX— a low-cost, intelligent statistical multiplexer.

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this kind of thing. What we've done is get a bunch of aggressive, self-motivated, pushy people. And I say to them, 'It's your job, now get the hell out there and do it, and you'll be rewarded in a big way.' We don't want people here looking for a home. We get 5,000 resumes a month. The word is out on us."

Virtually all hope of MCI's success was contained in the simple phrase, equal access, that was part of the court-ordered divestiture of AT&T. Equal access means, come next January, the local telephone operating companies will have to treat all long-distance companies exactly the same.

As it stands now, users of rotary dial telephones — which make up 60% of all U.S. telephones — must use special adapters to access MCI's network. In addition, an extra 12 digits must be dialed, or punched by pushbutton telephone users, to route a call via the MCI network. As of January 1, those impediments will be removed for MCI and all other long-haul carriers.

"The identification of an MCI customer today is the giant callous on his phone finger," MCI's chairman observed.

Thus, a huge portion of the long-distance market will be open to competition for the first time, with MCI looking to grab its share. U.S. Federal District Court Judge Harold Greene has decreed that the entire process of establishing equal access must be completed by 1986, but no definitive schedule for implementation has been prepared. The courts expect the operating companies to start with the major metropolitan areas.

But MCI and the other so-called resellers, which rent long-distance lines from AT&T and resell telephone service at a discount, will also have to give up something. Today, about 35% of AT&T's long-distance revenues subsidize the local operating companies, a subsidy scheme put in place by federal regulators to control the cost of local service. This scheme gives MCI and the resellers a cost advantage of up to 50%, fueling their growth because they are not forced to subsidize other parts of their companies from long-distance revenues. On January 1, 1984, MCI will lose its artificial price advantage and will have to compete with AT&T on a truly equal footing.

This could lead to the demise of the resellers. MCI, however, has its own transmission network that currently uses microwave transmission, but will be based largely around fully digital fiber-optic and satellite transmission in the future.

According to McGowan, MCI believes that AT&T's vertical integration will prove an albatross around its neck. AT&T Communications (formerly the Long Lines Division) will have to subsidize the parent's manufacturing arm, Western Electric, "which just can't be counted on to always produce the right product," McGowan contended.

> ***"My style's perfect for this kind of thing. What we've done is get a bunch of aggressive, self-motivated, pushy people. And I say to them, 'It's your job, now get the hell out there and do it, and you'll be rewarded in a big way.' "***

"That's when you'll really see how much better prepared we are for the telecommunications age than AT&T, how much better honed we are," he added. "They've got too much of everything — too much equipment, too many people, too much capacity in the wrong places. They have 16 levels of management, and we have five. They are not commercial people. I'm a commercial cat."

MCI's strategy is to promise any and all equipment vendors, including Western Electric, that it will never enter the equipment business and become a competitor. This, McGowan said, gives MCI "the advantage of saying to a supplier, 'Hey, you didn't guess right. I'm going to buy from someone else.' " This strategy has allowed MCI to become a test site for equipment vendors anxious for a piece of MCI's business. The construction of AT&T's New York to Washington, D.C. fiber-optic link is a conspicuous example of poor planning, according to McGowan. Using what he termed largely outdated, dual-mode fiber-optic cable, AT&T completed the system for over $125 million.

MCI is constructing the same

Roberts said, "We're a whole different story altogether. With the investments we're making in expanding capacity, we will continue to grow at least as fast as we have in recent years. I don't care if AT&T is worried — I know they should be."

link using 44-pair, single-mode fiber-optic cable capable of four times the bit transmission capability per pair of fiber. Using signal repeaters every 18 miles, compared with AT&T's use of repeaters every four miles, MCI will complete its system for under $35 million, McGowan claimed.

MCI's microwave towers look like scarecrows next to the more elaborate and much more expensive AT&T towers. Yet MCI's towers can be erected in a matter of hours and serviced remotely. The company is aggressively adding capacity to its microwave network, although its network efforts for the future are clearly directed elsewhere.

For one thing, the company has purchased 4,000 miles of right-of-way along railroad beds in the eastern U.S., which will be the path for an extensive fiber-optic network MCI is building. MCI obtained its cable from Sicor Corp. and Northern Telecom, Inc. and can splice the two firms' products together.

MCI also purchased 24 transponders on two Hughes Aircraft Co. Galaxy satellites, to be launched this year and next. The transponders will give MCI the equivalent of 48,000 additional voice circuits. In all, MCI will spend $1 billion in capital equipment this year and an estimated $2 billion next year, most of this toward the construction of a fully digital network.

Recently, the company signed a $9 million pact with Bolt, Beranek & Newman, inc. to supply a packet-switching network expected to form the rudiments of an enhanced data communications network. In April 1982, it hired former Tymnet, Inc. President Robert Harcharik to be MCI's vice-president of data services.

MCI is also conducting several experiments aimed at bypassing the local operating companies with its own point-to-point transmission capabilities. The company has launched two such experiments using the transmission capabilities of local cable television companies in the Omaha, Neb. and Atlanta areas. MCI is planning to have 10-GHz, point-to-point digital microwave capability in three major cities by year-end.

The ever-brassy McGowan, however, claims he has no intention of entering the local market. Rather, he said, "I just want to incense the Bell operating companies into doing the job they should, which is to provide us with quality service and an adequate bit stream capability at a reasonable cost."

Its equipment investments notwithstanding, the company is aggressively investing in what Bert Roberts, president of MCI's telecommunications division, called its most precious asset, its people.

"We are dedicated to the principle that we will not let this thing turn into some vast bureaucracy," Roberts said. "We hire only aggressive, tough people. We train them extensively. We maintain policies and procedures without which the growth we anticipate could be devastated."

The 40-year-old Roberts, who joined MCI as a vice-president in 1972, said that 80% of all MCI employees are part of the company's stock purchase plan. Executive salaries, he said, "are very heavily biased toward bonus positions, with stock options. We are not going to pay anyone a big giant salary to come in here and have a comfortable life, because it is not a comfortable life here. But, man, it is a rewarding one."

AT&T, Roberts said, has "a well-honed management team, but they just aren't used to operating the way a leading company should. They need fresh blood to look at things differently," he added.

"We're a different story altogether. We've been waiting for next year for a long time. With the investments we're making in expanding capacity, we will continue to grow at least as fast as we have in recent years. I don't care if AT&T is worried — I know they should be." ■

Laberis is senior editor, computer industry, for Computerworld.

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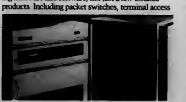

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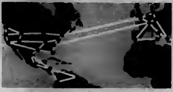

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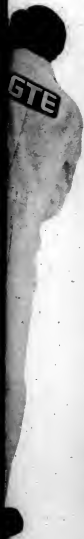
THE PITFALLS OF PURCHASING PBXs

What is a digital private branch exchange (PBX) evaluation really like? On what issues are purchase decisions really made? Are they the glamorous issues that technologists prefer to consider? The answer is that the technical issues carry only about half the weight in a decision.

Some users, especially the more sophisticated ones, initially anticipate having to carry out an in-depth technical analysis and comparison of the PBX architecture ▶

BY JAMES MORGAN

GTE



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Put two dozen PBX design engineer teams in a room and you will get two dozen different architectures. Who will be successful? It is necessary to turn to the nontechnical issues.

innards. They anticipate asking manufacturers' design engineers about such issues as backplane design, bus architecture, switching matrix design, and software philosophy. Some examples of other glamorous technical issues are:

- Digital switching.
- Integrated voice and data.
- Nonblocking.
- Least-cost routing, station message detail recording and automatic call distribution.
- Processor occupancy factor.
- Automated office workstation.
- Flexible, viable architecture.

It turns out, however, that the vendor evaluation process seldom goes this far. More mundane issues arise, presenting limitations that become so consequential to users that selection decisions must be based on them. Evaluators must consider such nontechnical issues as:

- Will the vendor — both local distributor and manufacturer — be in business five years from now, or even two years?
- What is the local distributor's reputation?
- How mature and field-proven is the product?
- How good is the manufacturer's track record for upgrades?
- How much will the manufacturer back up his local distributor?
- Price, delivery and training.

Because the nontechnical issues are crucial to the evaluation, analysis of the more esoteric technical issues is often put on hold. More likely than not, the evaluators say, "We never even got to that stage of technical depth." For example, the first-level block diagram of a vendor's PBX architecture is virtually never examined, even in a sophisticated evaluation. Such a diagram is meaningless — and actually misleading — without a lengthy explanation by the design engineer. This situation is further complicated by the fact that modern PBX design is 70% to 90% software, which an evaluator cannot see, unlike hardware design.

Put two dozen PBX design engineer teams in a room and you will get two dozen different architectures, most of which will work quite well. Who will be successful? It is necessary to turn to the nontechnical issues: The successful vendors will be those that can continuously provide strong answers to those questions.

It is necessary to provide an advance warning to prospective users who might otherwise underplay nontechnical issues. Two recent developments dramatize this warning. First, the first two digital PBX dropouts occurred in mid-1983, namely, Datapoint Corp. and Rockwell-Wescom. This should shake up evaluators who tend to think such things do not happen.

Second, the automated office race is operating at full speed and will strain the resources of all vendors, both manufacturers and local distributors. The race has escalated and prospective users should ensure that sufficient vendor capital, design talent, support staff, management commitment, upgrade capability and so forth are available.

Unfortunately, too many users make the nontechnical issues an afterthought. They get excited about the technology and base their evaluation heavily on it. When the initial evaluator — typically the telecommunications manager — distributes his evaluation report, questions about nontechnical issues arise.

For example, the financial officer asks: How financially stable are the vendors? Do they have the capital for continuous upgrades? Do they have the funds to overcome unexpected software problems? In addition, the purchasing officer asks: How well-proven is the product in the field? How many are installed? How satisfied are earlier users? Finally, the general manager asks: Will they stay in business? Why should I let them become my telephone company? Will they carry me into the automated office?

At this point, the evaluator must go back to the drawing board, shift gears to nontechnical issues and make another evaluation. This requires more vendor meetings, telephone calls to peer users

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and so on. The technical evaluator's afterthought turns out to be nontechnical management's prime thought. The project is delayed, and the evaluator's initial effort appears narrow-minded and weak.

The results of the second round of evaluations can be surprising and disappointing to the evaluator and his management. Sometimes the top technical vendors have been found inadequate on a nontechnical basis. For example, all manufacturers have some weak distributors around the country. As a result, such vendors are dropped out of the competition, and less technically advanced vendors move up to win the award. The nontechnical evaluation results must be excellent; technical results can have more leeway.

The smart user will recognize this from the beginning as he plans his evaluation strategy. Specifically, his request for purchase will solicit information on nontechnical issues. Next, the user will give these issues serious consideration during the vendor evaluation. Finally, these issues will be prominently included in the detailed, user-written contract.

The smart user will recognize that the majority of troublesome PBX projects occur because nontechnical issues are underplayed and underevaluated. For example, some technically strong manufacturers have weak local distributors that slip installation schedules, provide poor response to maintenance calls and even go out of business.

THERE ARE STRONG local distributors handling manufacturers that take a long time to solve software problems, due to shortage of capital and lack of upper management committment. In addition, there are immature products that encounter problems at cutover, which are eventually resolved, but only after months of anguish. The best evaluation considers both technical and nontechnical issues simultaneously, giving each set of issues ample attention. If a major flaw is found in either set of issues, the vendor is dropped immediately.

An efficient evaluation for a user who seeks a reasonably advanced PBX should include the four steps outlined below. This assumes that the request for purchase asked for both technical and nontechnical information and that vendors supplied this information.

- *Phase 1.* Perform a quick read-through of each proposal to find major flaws in either set of issues. If such flaws are discovered, drop that vendor or ask for further clarification.
- *Phase 2.* Simultaneously pursue both technical and nontechnical issues in enough depth to narrow the field down to about three finalists. The James Morgan Library article, "Do I Have to Evaluate Every One of the 20 Digital PBX Manufacturers," describes the three levels of evaluation for narrowing the field down to three finalists. There is a slight favoring of the technical side during this phase.
- *Phase 3.* For the three finalists, simultaneously perform heavy evaluation for both sets of issues. The results of Phase 2 have produced considerable confidence in the finalists' technical capabilities, but additional technical evaluation is required — for example, more absolute proof of promises. In Phase 3, heavier emphasis is given to nontechnical issues. For example, the user's finance officer performs a Dun & Bradstreet check and asks vendors to supply evidence of financial stability and viability.

Depending on the size of the project, a user team might visit vendor facilities such as local distributors' operations and distant manufacturers' engineering offices and plants. The user team might include the telecommunications manager, purchasing officer, financial officer, upper management and others. For smaller projects, the finalist vendors can make across-the-board presentations for the team at the user site.

- *Phase 4.* Write the final evaluation and select a vendor. List one or two dozen broad categories for comparison and assign a weight to each one. At least half of these will be nontechnical and should be given heavy emphasis. Give each finalist vendor a rating in each category. After figuring out the totals, use these numbers as a guide. Award the contract to the vendor with which the user team feels most comfortable.

Unfortunately, there are users with installed systems that have yet to feel the adverse effects of their too-casual evaluation on nontechnical issues. In the future, some of these users will begin to experience problems.

On the other hand, some of the too-casual evaluators may be lucky and select a good vendor. At any rate, these problems can be avoided by giving nontechnical issues careful consideration from the start. ■

Morgan is founder of J.H. Morgan Consultants, which is based in Morristown, N.J.

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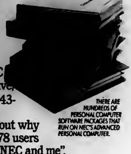

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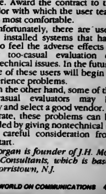

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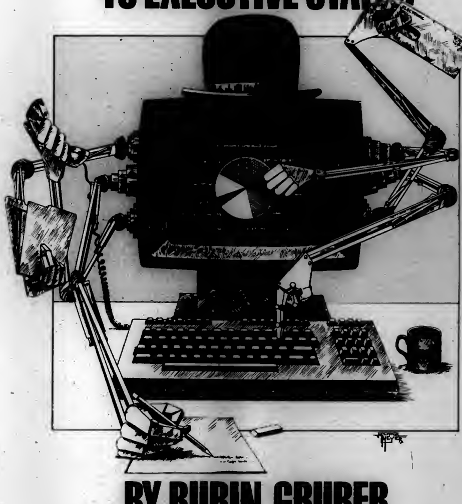
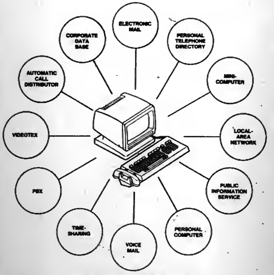


BY RUBIN GRUBER

Recent years have seen an increase in the diversity of information sources required by executives and the importance of their direct access to corporate data bases. There is increasing use of the emerging electronic mail, voice mail and outside information services. In addition, the new, more powerful private branch exchange (PBX) systems have added a level of complexity and a requirement for voice and data integration.

Workstations previously available for executives have generally been the terminals designed for use by management information systems professionals and other frequent terminal users. They are powerful, but often require extensive training to use. Those more recently designed for managers are easier to use, but lack sophisticated features. And virtually all terminals have been designed to work with only one type of computer system.

While the term "executive workstation" was born from the need for executives to access information more easily, it has become synonymous with multifunction workstation. Far more executive workstations are used today by managers and professional-level staff ▶



Ideal Executive Workstation

than by executives. What categorizes a terminal as an executive workstation is not so much the type of user, but the way it is used and the types of information it is used to access.

Unlike the devices it replaces, the executive workstation is an office tool, designed to be placed on a standard office desk. For this reason, it is generally smaller than standard terminals. The newest workstations have more compact screens, smaller keyboards and more compact bases to contain their newer generation electronics. They are designed to reduce desk space requirements.

Typically, users of executive workstations spend relatively few hours per week at a terminal, and they do more information seeking than inputting. At the managerial level, the information required is part of the decision support process. At other levels, it is part of an increasing flow of information used to perform tasks such as telemarketing, customer service, financial analysis and market research.

Today's executive workstations come in three basic forms: intelligent telephones, multifunction terminals and personal computers. Each was designed from a different perspective to function as a personal information tool.

Intelligent telephones, provided by the voice-oriented companies, place heavy emphasis on voice. Their small screens and keyboards and limited communications capabilities make them best suited for users who infrequently access data. Multifunction terminals, on the other hand, strive for full compatibility with the host computers and offer nearly all the features of dedicated single-function terminals. Personal computers place most of their emphasis on local processing, with secondary emphasis on data or voice communications.

Regardless of their original roots, most of these are converging on a single goal — the total communications tool that is equally at home with all forms of data and voice communications.

The greatest body of information maintained in large corporations is in mainframe data bases that result from the processing of operational business transactions. While portions of the data base are contributed by various departments, they are maintained and consolidated centrally.

Originally, most users gained access to the corporate data base through printed reports. A marketing manager who wanted to know the number of units sold by his regional sales office would read a printed report. Such reports often proved unsatisfactory sources of information. They were printed periodically, so information presented in them was seldom current. In addition, the report contained a lot of information each individual did not want, and the information usually was not in the form to answer a specific question.

Data base management systems have enabled the structuring of these data bases so that specific questions are more easily answered using on-line inquiry programs. This has increased the requirement for the use of display terminals as part of the decision process.

A display terminal may also provide access to outside data bases. Public information is provided on time-sharing computers and includes news, financial data, econometric data and models, research data bases and other specialized information. These information data bases provide a level of detail that very few individual

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organizations could afford to maintain.

To maximize access, these services have standardized communications protocols accessable by virtually any communicating terminal device. The problem they have not overcome is convenient access. While these services are generally easy to use, providing on-line menus and Help screens, access requires a complex series of dial-in and logon steps.

The Davox Communications Corp. Executive Deskset addresses this problem by providing user-friendly keys that the user can personalize to log on to any application, whether on a local computer or a distant data base. In the latter case, the steps of dialing out of the PBX, accessing a communications network, logging on to the desired computer and going directly to the application can all be done by pressing a single button. All of the necessary pauses for dial tones, handshakes and logon dialog are handled automatically.

The '70s saw the rapid growth of the minicomputer, not as a replacement for the mainframe, but offering a new capability not previously available. While mainframe programming backlogs were running two years and longer, minicomputers with turnkey applications could be installed within two or three months.

FROM THEIR start, minicomputers stressed direct user involvement in on-line applications and corresponding user-friendliness. Minis were frequently designed as office machines, intended to be operated and managed by non-DP staff.

The personal computer picked up the minicomputer's momentum, adding a dimension of its own. It was the first computer designed to be used by just one person, as personal a tool as the telephone or the pocket calculator. The user acquired power never before available by being able to manipulate his own information. Much of the credit for the early acceptance of the personal computer as a business tool has gone to the introduction of spreadsheet programs that allow useful financial modeling.

Still considered a fad as recently as a year ago, the personal computer is rapidly becoming established as a serious business tool in large corporate environments. The introduction of personal computers by established office automation companies such as IBM, Xerox Corp., Hewlett-Packard Co. and Texas Instruments, Inc. further legitimized their role in the office, where many perceive them as the ideal executive workstation.

But with the personal computer came a new dilemma. While the personal computer provided low-cost capabilities, there was no tie-in with the corporate data base. The personal computer operates in a self-contained world. A personal computer user has at his disposal only the information he input himself, not the vast corporate data base or range of outside information.

The successful executive workstation must provide not only local processing capabilities, but also access to the mainframe. Although there are several schemes for doing this, optimal use of the mainframe calls for true compatibility and IBM 3270 emulation. The 3270 has become the common denominator for mainframe communications, not only with IBM and IBM plug-compatible systems, but also with other mainframe vendors that now offer 3270 communications.

Another problem with the personal computer is that it is a machine. Regardless of how friendly a micro's applications are, users cannot escape having to use operating system utility programs, printers and modems; to make disk backup copies; and to retype data that disappeared from a floppy disk.

Unquestionably, the

Introducing 3M's Whisper Reader portable communications terminal.

Electronic message, data access, ASCII, and TWX/Telex communications in a low-cost, lightweight package.

At first glance, 3M's new Whisper Reader looks like a very small portable computer. But it's actually something far more useful for the typical business user:

- It's a terminal that hooks up to electronic message centers like the 3M Whisper Exchange, using its own built-in modem
- It communicates with any TWX or Telex machine
- It can be used to access computer databases from home or while traveling.
- It can function as an ASCII terminal within an organization's own data communications network

The price? Lower than you might think, especially when you consider that it can increase your communications flexibility without requiring you to buy a lot of extras.

Weighs 2 pounds, fits virtually any briefcase. Perfect for sales reps or traveling executives, since it's no bigger than a book. Battery-powered for even greater convenience.

16K memory in up to 20 separate files, plus a self-contained text editing program. Messages can be written, edited, and stored for later transmission or recall. Maximum file size is a generous 14,000 + characters.

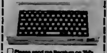
Direct-connect modem standard; acoustic coupler optional. There's even an optional RS-232C or parallel interface for use with printers or electronic typewriters.

Optional automatic answering device. Allows 24-hour communications

Dow Jones access. Single key access to current Dow Jones stock quotations.

Human-engineered for ease of use. 40-character display shows upper- and/or lower-case characters, QWERTY-based keyboard is compact, yet meets the needs of executive "hunt-and-peck" typists. Help messages are built in to guide users, and no programming knowledge is required.

Calculator, calendar, alarm clock, and other handy functions. There isn't room in this ad to list all of the new Whisper Reader's user-oriented features. For literature or a demonstration, call 800-328-1684 toll-free. In Minnesota, phone 800-792-1072; in Canada, dial 1-800-268-0955 and ask for Operator #11. Or simply mail the coupon.



☐ Please send me literature on 3M's new Whisper Reader
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dominant office information tool is the telephone. It is also the most personal information tool. Unless it is connected to a speakerphone that permits a small group of people to share a call, it is always used privately. An individual's personal telephone directory is equally as private.

It was only natural, then, for several manufacturers of executive workstations to include telephones in their products. And since many information services are accessable only by telephone dial-up, many were given the ability to dial into them. The incorporation of a telephone in a data terminal and the provision to dial directly into an information service represent a limited form of voice and data integration. True integration of voice and data awaits the large-scale conversion of the analog telephone circuits to digital.

> ***The term user-friendly has been used so much recently that it has begun to lose its meaning. User-friendly means that someone who has not previously used a device or an application should be able to learn to use it with very little training — or none at all.***

Executives really need two tools. One is a personal computer that provides information on a personal level, independent of any other computer system. In addition to allowing the user to manipulate small, personalized data bases, it can store private information such as drafts, notes, to-do lists, personal telephone directories, personal calendars and private correspondence.

The other is a terminal capable of accessing any corporate computer or outside facility, utilizing both data and voice communications. And to keep the whole thing economical and utilize a reasonable amount of office space, both types of capabilities should be combined in one unit.

Two major solutions have emerged. One enables the personal computer to function as a terminal, so that it can also access a larger computer when necessary. Historically, computer equipment has tended to be either good at processing or good at communicating, but not very good at doing both at the same time. This has been no less true with the personal computer. Until recently, applications on personal computers did not communicate with each other, and the ability to move information between a personal computer and other information systems has been almost nonexistent.

The other approach involves placing a powerful multifunction terminal on the executive's desk and giving it the ability to communicate with any type of computer: mainframe, minicomputer, personal computer or dial-up information service.

This accomplishes three objectives. First, it provides a better terminal for mainframe access. Since 3270 operation is central to efficient access of mainframe information, a terminal designed to input and display information properly in 3270 formats has a distinct advantage. Second, the terminal with personal computer access takes the processor, disk drives, cables and related computer hardware associated with a personal computer off the user's desk, leaving just the keyboard and display. Third, by placing heavy emphasis on communications capabilities, the user is left with more flexibility to use other forms of information in the future.

This kind of flexibility is one of the most important factors in executive workstation design. Each of the potential information sources was independently created, and most systems made by separate vendors remain totally incompatible. The ideal executive workstation must have broad generic capability to be used with today's varied information services, because the future of many technologies is so uncertain. At the same time, it must allow the user to personalize it to meet his specific needs conveniently.

The term user-friendly has been used so much recently that it has begun to lose its meaning. User-friendly means that someone who has not previously used a device or an application should be able to learn to use it with very little training — or none at all. Furthermore, once the tasks to be performed are identified, they should be accomplished in full by

TOMORROW'S DISTRIBUTED SWITCHED DATA NETWORK TODAY.

RIXON'S Data Concentration Exchange (DCX) is a revolutionary concept in data communications equipment by combining distributed switching, statistical multiplexing, concentration, contention, and network processing functions.

DISTRIBUTED SWITCHING allows a terminal user direct connection to a local CPU or remote CPU without having data transmitted to a central switch and back over the same line. It will also save you the expense for multiplexer hardware, excess cables, computer parts, communication links, and the modems required when using a central data switch.

CENTRALIZED MANAGEMENT AND CONTROL is established by making one node the master over all other DCX switches and multiplexers. Faults can be localized to individual ports and/or network links as everything can be managed from one node.

RESOURCE SHARING capabilities of the DCX line of products gives you your own digital PABX system. This allows intereonnect to as many as 15 other DCX switches and as many as 63 in a single network. Access levels restricting certain computer facilities for security reasons are easily assigned with the DCX products.

With a DCX at your local or remote cluster, you can minimize your hardware investments by having everything needed in one box. You eliminate your central switching device, multiplexers to serve each remote cluster, and excessive cabling between data switch ports and the multiplexer ports. The cost of the DCX is application dependent, but will be less because you are purchasing a complete system in one cabinet from one company.

Call Dave Shaffer so he can explain to you in detail how you can benefit from RIXON'S family of statistical multiplexers at (301)622-2121, ext. 471, or write to RIXON at 2120 Industrial Parkway, Silver Spring, Maryland, 20904

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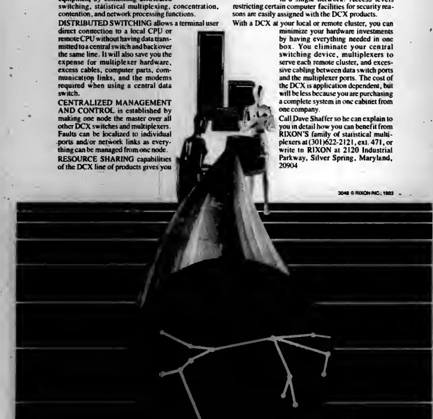

The executive workstation is still an evolutionary concept, early in its life cycle, and it must be able to adapt to potentially hundreds of tasks. At the same time, if the user is to benefit from its use, he must be both familiar and comfortable with the workstation.

simply pressing a button. In the case of single-function devices, such as the cash register/terminals used in many fast-food restaurants, this has been accomplished by designing both the terminal and the application to anticipate the most frequently required tasks.

The executive workstation is still an evolutionary concept, early in its life cycle, and it must be able to adapt to potentially hundreds of tasks. At the same time, if the user is to benefit from its use, he must be both familiar and comfortable with the workstation.

Familiar refers to functions that are logical and operate in a fashion similar to the way one would ordinarily expect to perform them. For example, the telephone directory in the Davox workstation was designed to operate much the same as the desktop manual directories it replaces. New users instantly understand how to use it because it is familiar. Similarly, it includes buttons that the user can personalize to his own needs, whether to log on to a mainframe application, perform a complex PBX function or read an electronic mail message.

Comfortable refers to the user's belief that an operation will provide the results he anticipates. Real comfort with a workstation involves an absence of fear of the device and a knowledge that serious mistakes cannot be made. Screen messages and prompts should be in English, so that interpreting them does not require use of the reference manual. Related functions should be made similar in operation, so that a user who learns to do one thing instinctively knows how to do other things.

Other user-friendly characteristics include keyboards that feel good to type on, result in few errors and can be placed in a convenient location; screens that are easy to read; audible and visual prompts; and a built-in Help or training facility. Many of these are the same ergonomic standards that have been developed for terminals designed for full-time users.

Some systems may have gone too far toward user-friendliness, because a system must be easy to learn and efficient to use once it has been mastered. Too much friendliness in the form of prompts and layers of menus can slow down the operation of a workstation, making it frustrating to use later. The ideal device, then, uses enough prompting to get the user past the early learning hurdles, without later slowing him down or consuming excess system resources. And the more the workstation has been designed to make its operation intuitively obvious, the less prompting will be required.

The future of the executive workstation is intimately linked with developments that are taking place in voice and data technologies. As voice and data converge, products that incorporate still greater user-friendliness will become available. Once voice is digital, it can be integrated with data on a single pipe, using local-area networks, protocols to use PBXs and many unique features.

A major role of the workstation will evolve as a means to manipulate and move data from one medium to another in every possible direction — outside the data base to personal computer to mainframe to minicomputer and voice. This will require still greater ability to communicate with many types of systems, to extract the specific piece of required data and to translate it into the correct protocol and format.

Reflecting the way people like to work, the workstation will also continue to evolve in a more human direction. Although it will perform more complex tasks, it will also become easier to use. The user will acquire the ability to browse through information to look for something interesting, test ideas and hypotheses without the need to write new programs and receive answers to questions asked in plain English. ■

Gruber is president of Davox Communications Corp., Merrimack, N.H.

What's a 7-letter word for a data switching system that lets you expand your network as far and as fast as you like?

Xplexer. It s Tellabs' modular, expandable, high-performance data switch that's versatile enough to answer your present network needs and flexible enough to face a future filled with change. You can add terminals at any time because the Xplexer's terminal interface capacity is virtually unlimited. Should the need to interface only a few remote terminals arise, the Xplexer's integral line-driver option is your answer. Or, for very affordable communication with larger groups of remote terminals over a single link, pair up your Xplexer with Tellabs Dataplexers, our high-speed statistical multiplexers. If you decide to interconnect several local networks, the Xplexer can handle that, too. It can join as many as 256 switching nodes. And it supports multiple composite links at speeds up to 76,800bps.

Menu-driven configuration and statistics control, switched or permanent virtual circuits, channel-speed conversion, alternate routing, nonvolatile memory: the Xplexer has all the answers. It's the perfect solution to your port selection, extended network, and distributed network puzzles.

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Our Tandem NonStop computer helps us dramatically streamline order tracking for our broad line of products here at the Collins avionics facilities in Cedar Rapids. This automated operation has meant we've been able to ship our products faster, as well as respond to customer inquiries in a much more timely, accurate fashion.

The Tandem system consolidates all data pertaining to the orders, from order entry to scheduling, inventory issue to packing lists, and right on down the line to shipping. And, because the system is on-line, other departments have immediate access to this information as well; Accounting, for example, now generates invoices automatically, resulting in much improved cash flow; Manufacturing is saving $175,000 a year in internal freight charges due to the reorganization of ordering and shipping procedures; and the Group as a whole has been able to eliminate more than 300,000 reproduced documents a year.

Other system benefits contributing to our improved customer service include better control of backorders, more accurate pricing information, and the ability to make detailed forecasts of market conditions for planning purposes. The net result is an operation that is helping us achieve some very significant gains in plant productivity."

The NonStop System. Ideally suited to on-line transaction processing where continuous availability of up-to-the-second information is critical to your business.

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For information on how a Tandem NonStop system can improve your productivity or your P/L statement, call your local sales office or Tandem Computers Incorporated, 19333 Vallco Parkway, Cupertino, California 95014, U.S.A. Toll Free 800-482-6336 or (408) 725-7500 in California.

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[illegible] telephone access to your computer while managing the growth of dial in capability [illegible] has never been easy. Until now! Introducing Defender II. The next generation.

Defender II provides a unified approach to the intelligent management of dial-up modems at your computer site. Any number of Defender IIs can be configured with up to 48 modems each, and all may have their access controlled through dial-up call-back procedures. That means security. For yourself. And, more importantly, for the information in your computer.

Each Defender II modem is monitored on a continual basis. All transactions are reported to a printer, terminal and/or computer, including telephone call origination and termination times, duration of call, supervisor access and more. This, combined with our Least Cost Routing technique, brings computer phone-line costs back under your control.

Moreover, by utilizing Digital Pathways' proprietary, [illegible] controlled 212A modems, Defender II offers something totally unique: the ability to automatically send messages to a predefined list of phone numbers. Especially useful for distributing computer status information, product announcements to sales forces or any other mass distribution message. This computer-independent messaging provides an invaluable tool in computer [illegible] situations.

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Canada (403) 286 2744

AN INTERVIEW WITH KENNETH BOSOMWORTH

Kenneth Bosomworth, founder and president of International Resouce Development, Inc. (IRD), has traveled a peripatetic path in becoming one of the communications industry's most well-versed and quoted analysts. Born 43 years ago in the UK, he still maintains his British citizenship even though he has lived in the U.S. for over half his life and continually since 1971, when he started IRD in Ramsey, N.J.

Bosomworth attended school in the UK until his senior year in high school, when he studied in Oregon as an American Field Service exchange student. He returned to his native land, earning a masters degree in physics at Cambridge University. He then worked in the UK and Sweden, where he was recruited by Westinghouse Corp. and subsequently sent to Canada.

From Canada, he made stops in the Bahamas and Paris. In Paris, he put his consulting expertise to work for a U.S. company, Data Systems Analysts, which eventually transferred him to New York. He is now ensconced in New Canaan, Conn., with his wife and two daughters. IRD is currently located in nearby Norwalk, Conn.

Computerworld On Communications *Editor Bruce Hoard interviewed him in his crowded, unkempt IRD office, where he was surrounded by stacks of the reports and studies that are the lifeblood of IRD. Casually dressed in an open shirt and deck shoes, the bearded Bosomworth expanded on a wide variety of communications topics.* ▶

JAMES KAVALLANES PHOTO

What do you think are the most dynamic areas of communications technology today and what is happening in them?

Over the past 100 years, it has been a seesaw between cable and radio. Sometimes cable has been in the ascent, and sometimes radio has been in the ascent — that's true in both short-distance and long-distance communications. We now have a situation in which both radio in the form of satellite communications and cable in the form of fiber optics are growing at unprecedented speeds.

The underlying economics is interesting in that it promises much cheaper communications.

> ***"Data communications is terribly important, but I think it is important to keep reminding oneself that the world of communications in terms of revenues, channel miles, its impact on society or anything else is still mostly voice-oriented."***

How much of the new technology is actually available to users?

More than 80% of communications is voice today, and much of what isn't voice communications — as the satellite companies have found — turns out to be people transmitting movies, entertainment and a variety of things. Data communications is terribly important, but I think it is important to keep reminding oneself that the world of communications in terms of revenues, channel miles, its impact on society or anything else is still mostly voice-oriented.

How about the data side?

I think there have been a number of false starts conceptually in the data communications field, but today it is a much more sensibly viewed business than it was 20 years ago.

In 1965, AT&T ran a series of ads in *Fortune, Scientific American* and other magazines saying that 10 years from then — in 1975 — 50% of all communications in the U.S. would be data and that computers would be talking to other computers.

In fact, what happened between 1965 and 1975 was nothing like that at all. By 1975, only about 10% of communications was data, and almost none of that was computers talking to computers. There was a little bit of that, but most of it involved terminals with people at them talking to computers and computers talking back to them in various modes.

Can you think of any other new exciting technology that is coming into the communications area?

Well, there has been a lot of ingenuity exercised in the modem area, squeezing more and more performance out of primarily telephone channels at lower and lower prices. The price of modems has some significance in terms of the future growth of data communications because for the first time, the home market becomes accessible to data communications manufacturers that are selling modem chip sets for less than $30.

Generally speaking, in communications, how long of a break is there between the time a new technology is introduced to the time it actually becomes refined to the point where people want to use it?

From the time that the gleam first appears in the scientist's eyes to the time that it is generating revenues is probably still in the eight- to 10-year period, but some of the intervening activities in terms of commercializing new technology are becoming more and more telescoped.

So, from the time that a modem chip is dreamed up to the time it is produced in large quantities might be only a matter of three years. And in some cases, it is shrunk down to a year and a half or a year.

What kind of technology and products are computer users demanding right now? Let's put it on the data side.

Major computer users — that is, the Fortune 500 and top banks, insurance companies and so forth — for the most part have directed their development of networks in

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TYMNET is growing because customers are recognizing the value of our proven technology. We are committed to support you today and in the future — whenever you grow.

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The edge of data link technology.

Cost-effective 19,200 bps data communications
utilizing 9600 bps hardware and voice-grade lines.

Symplex

SYMPLEX COMMUNICATIONS CORPORATION

[illegible] that [illegible] throughput [illegible] reducing costs.

The Datamizer is both a unique and powerful data compressor and a sophisticated statistical multiplexer. Working in pairs, the Datamizer effectively *doubles* data throughput over any 9600 bps unconditioned voice grade nr DDS line, dramatically reducing errors, improving response time, and doubling line capacity.

The Datamizer will save thousands of dollars in data communications costs while dramatically improving your throughput efficiency.

Compresses data 2:1 or better.

Utilizing SCC Tabling™ Symplex's exclusive data compression algorithm, the Datamizer effectively reduces the volume of any 8-bit data stream by *50% or more*. This process immediately *doubles* line capacity, enabling transmission of twice the volume of data, or the same volume in *half the time*. Both of these features can be utilized *in any combination* to achieve maximum throughput efficiency in your data link.

A high speed link.

The Datamizer provides you with a low cost, high speed data link, without expensive conditioned lines and costly, less reliable high speed modems. By compressing data, the Datamizer achieves a net throughput of 19,200 bps over any voice-grade or DDS line, utilizing any standard 9600 bps modem or DSU. What's more, nperating at 9600 bps, the Datamizer virtually eliminates the often excessive errors experienced with 14,400 and 16,000 bps modems.

Cuts line charges in half.

By *doubling* the throughput capacity of any 9600 bps line, the Datamizer will immediately eliminate the need for multiple lines running to the same destination. Removal of these redundant lines will save you significant costs *each month*.

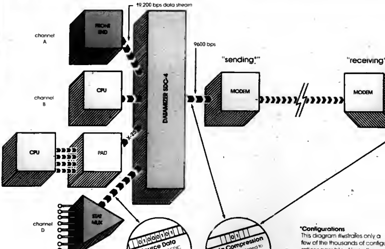
Improves response time.

The Datamizer significantly improves the response time of data terminal equipment by reducing the volume of data transmitted, and by reducing data packet retransmissions due to errors.

Supports all Protocols.

The Datamizer is uniquely designed to be totally non-protocol dependent, and entirely user transparent. The units will support both synchronous and asynchronous, half or full-duplex protocols with no special "set-up" programming, and no charges to your present equipment.

The Datamizer at work.



Innovative Data Compression.

The heart of the Datamizer is SCC Tabling, Symplex's automatically optimizing data compression algorithm. This system continually analyzes the data stream, and automatically shortens repetitively transmitted character codes to new shorter "subcodes." These subcodes are compiled in a "frequency table" which is automatically updated on a second-by-second basis, the more frequently the character appears, the shorter it's subcode.

This process results in data compression ratios of 2:1 or *better*, and enables any modem or DDS line to operate at *double it's rate*.

The Datamizer units work in pairs, one on each end of a full duplex communications line. They are installed between a modem or DSU and your data terminal equipment. Each Datamizer is capable of both compression and expanding data to permit full duplex operation.

***Configurations**
This diagram illustrates only a few of the thousands of configu
rations possible utilizing the Datamizer. Data is shown flowin
in only one direction, while the Datamizer actually operates in full duplex

Flexible Multiplexing.

The Datamizer is also an
utilizes dynamic band widt
ously multiplexing a *differ*
at an independent rate.

The Datamizer has the
put rate into two 9600 bps
transmission efficiency and

Furthermore, the Data
permit all four channels t
input of 38,400 bps.

Key Features:
- **Data Compression 2:1 or better**
- **Doubles existing line capacity**
- **Built-in 4 channel multiplexer**
- **Compatible with Asynchronous or Synchronous protocols**
- **Supports bit or byte oriented protocols**
- **User transparent**
- **Operates with standard modems or DDS lines**
- **Full error detection and correction**
- **Service and maintenance network**

Power Monitor Lights.
Indicates proper functioning of
supply and the presence of ap
voltages.

Symplex DATAMIZER

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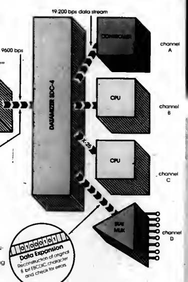


dvanced 4 channel statistical multiplexer, which
allocation. Each channel is capable of simultane-
ent half or full-duplex communications protocol

unique ability to divide it's 19.200 bps through-
channels or four 4800 bps channels for *peak* data
convenience.
mizer will accept one 19.200 bps input or will
be set to 9600 bps, resulting in an aggregate

YES! I'd like to hear more about how the Datamizer SDC-4 will improve efficiency and reduce costs in my particular application.

NAME ____________________

COMPANY ____________________

TITLE ____________________

ADDRESS ____________________

CITY ____________________ STATE ____________________

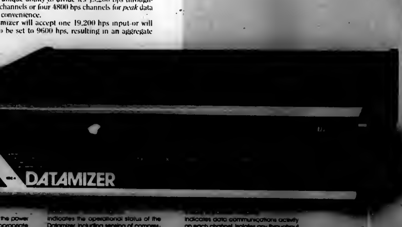
COUNTRY ____________________ ZIP ____________________

PHONE ____________________

Or call (313) 973-1164 today!

Statistics Monitoring and Fault Isolation.

Each Datamizer is equipped with a *Command Port*, enabling the interface of any standard ASCII terminal for reliable fault isolation, retrieval of network statistics, and Datamizer programming. Current compression and line utilization ratios, as well as a complete breakout of the operational status of each item of equipment in your data communications link can be monitored with ease. Each Datamizer is also equipped with a full array of LED indicators to provide real-time monitoring of transmission performance and line status. These indicators are especially useful when utilising DDS lines where no modem line status indicators are present.



the power
appropriate

Indicates the operational status of the Datamizer, including sensing of compression, error buffer overflow, and operation of the remote link.

Indicates data communications activity on each channel. Isolates any throughput brakedown in your data link.

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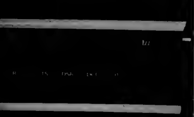
The Guarantee.

The Datamizer is built for outstanding performance and reliability. The Datamizer is guaranteed to provide double the data throughput, up to a full 19,200 bps. If the Datamizer fails to achieve this performance when used according to our published specifications, Symplex will provide a refund of the original purchase price. See our published guarantee for complete details.



Symplex SDC-4 Specif

General Information.

The Datamizer SDC-4 permits up to 4 sy
devices to share one common tranmission
compression, the SDC-4 allows the sum of
the composite channel by a 2:1 or greater rat
supported, as well as both bit and byte orien
compresses data, text, numerics, graphics o
are installed between any standard commur
your data terminal equipment.

Multiplexer Inputs

Number of Channels:	4
Maximum Aggregate Input:	38,400 bps (single ch 24,000 bps (with singl
Synchronous:	
Speeds.	1200, 2400, 3600, 480
Modes:	Half and/or full duple
Protocols.	Bit-oriented (X 25, SDL (Binary synchronous 2
Codes.	Any 8 bit code includ
Asynchronous:	
Speeds.	300, 600, 1200, 1800,
Codes	7 or 8 data bits, ASCII
Interface:	EIA RS232C/CCITT V 2 constant or simulated with tail circuits and m

Composite Channel

Data Rate	Up to 9600 bps extern
Interface	EIA RS232C CCITT V 2
Transmission Mode	Full duplex, synchrono
Error Correction.	ARQ (Automatic Requ

Data Compression

Algorithm:	See tabling A. Proprie coding with auto-ada synchronous characte
Code Set Updating Scheme:	Automatic frequency loading to remote cor decays.

Reliability and Maintenance.

The Datamizer SDC-4 was engineered for y
Extensive quality control in all phases of con
manufacturing assure exceptionally high r
Symplex offers onsight maintenance and rep
press relacement service. At Symplex, we're co
your system up and running at it's maximum

Symplex

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fications

nchronous or asynchronous
medium. By means of data
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annel speed maximum 9600 bps)
e channel speed 19,200 bps)

0, 7200, 9600, 19,200 pbs
:.
C, or HDLC, etc.) Byte-oriented
780, 3780, 3270, etc.).
ng EBCDIC and ASCII.

2400, 4800, 9600, 19,200 bps
odd, even or no parity
/V.28 Female 25 pin (DP-25-P).
carrier, buffered clocks for use
odems. RTS/CTS delay selectable

ally clocked
/V.28, Male RS232C (DB-25-P)
us. Similar to CCITT X.25 Level 2.
est for Retransmission)

ary adaptation of Huffman en-
ptive frequency code set, auto-
r stripping
code update and downline
npactor when compaction rate

Control Port

Interface:	EIA RS232C, asynchronous full duplex ASCII with auto baud rate
Functions:	Diagnostics, statistics and user programmable options.
Remote Downline Loading:	Automatic

General Specifications

Multiplexer Type:	Statistical byte oriented
Buffer Size:	14.5K send and receive data buffers, dynamically allocated
Flow Control (Programmable):	Synchronous: CTS Clock speed regulation. Clock off Asynchronous: CTS DTR X-ON, X-OFF
Status Displays (LED Indicators):	Composite: TXD, RXD, RTS, CTS, DSR, DTR, DCD Mux Channel Displays: TXD, RXD, RTS, CTS, DSR, DTR, DCD
System Operation:	Remote Link, buffer overflow, link errors, compression
Power Monitor:	+5, +12, −12

Physical

Dimensions:	Width—12.75" Height—3.5" Depth—19"
Mounting:	Rack mount or table top.
Weight:	11.25 lbs

Environmental

Temperature, operating:	0° to 35°C, 32° to 95°F
Temperature, non-operating:	−25° to 50°C, −13° to 122°F
Humidity:	0% to 95% relative, non condensing.

Power

117 VAC ±10%
57 to 63 Hz
Less than 100 watts

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nponent aquisition and unit
eliability. At the same time,
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the past 10 years along the IBM 3270 avenue, getting them fully into the [Systems Network Architecture (SNA)] way of doing things. Now, integrating personal computers into these 3270-SNA networks seems to be a major focus of interest as far as users are concerned. Users also want a full T-1 digital channel from one end of their networks to the other, and that time is approaching.

How soon will that time come?

It's partly a function of geography and partly a function of AT&T's politics. T-1 is being tariffed in some jurisdictions this year and more next year, so there will be people using it within a few months. But they will not necessarily be able to go every place they want to go. They might be able to get from Seattle to Chicago, but they might not be able to get from St. Louis to New York.

Focusing on the shorter range for data communications, on the 3270-type networks, there is a lot of interest in the whole issue of local networks and digital [private branch exchanges (PBX)]. There is a great deal of uncertainty about the correct path for future planning. This user uncertainty has been exploited successfully by the companies that have understood it and less successfully by the companies that haven't.

Which companies have understood it?

A company that has really understood the whole psychology of user planning uncertainty in the local network and PBX environment is Rolm Corp. Since 1977, Rolm has been addressing that issue with a range of products which certainly did not have data multiplexing and switching capabilities in 1977. But today, they either have that capability or can be upgraded for it.

The latest wisdom seems to be that PBXs and local-area networks are going to work together. If that is the case, doesn't that mean that local-area networks like [Xerox Corp.'s] Ethernet are going to play a subservient type of role — a role that their manufacturers won't be happy with?

The development of local networks in general is certainly assuming a vastly different course today than the Ethernet planners thought of more than 10 years ago. It is even different from what many industry analysts thought it would be like three years ago.

The general wisdom initially was that you had a local network for a whole building. You have a building of 1,000 white-collar employees, for example, with a local network that links up to the desks of all of them and also ties in with central resources in terms of electronic filing, high-speed printing and so forth.

There have been some users who have installed that type of system, but the vast majority of local networks have turned out, at least so far, to have been implemented on a much less ambitious scale.

As a matter of fact, in a building with 1,000 employees, it is fairly common today to find six or seven separate local networks, none of them with more than 12 or 15 users, none of them able to talk to each other — and no one necessarily wanting to — and none of them linked into any central resource systems at all.

> ***"In a building with 1,000 employees, it is fairly common today to find six or seven separate local networks, none of them with more than 12 or 15 users, none of them able to talk to each other and none of them linked into any central resource systems at all."***

Where does the PBX fit into this?

In many cases, it need not But for users who have a relatively light data communications requirement, it is much more straightforward to use the PBX than to try to dream up local network schemes.

But for people that have large data communications requirements and large numbers of terminals relative to telephones, the advance-function digital PBXs being marketed today by AT&T with System 85 and so forth all tend to be significantly more expensive on a per-connection basis than a largish local network. So the economics today for a user with a significant number of terminals seems to be that Ethernet or other

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local network architectures are much less expensive than digital PBXs. The user that has a relatively small number of terminals is likely to find a digital PBX gives them much more flexibility in terms of location of terminals.

Who will benefit and who will lose when AT&T becomes fully divested next year?

First of all, the deregulation of telecommunications is probably going to benefit business users and resident users, although the benefits are more immediately applicable to the business users. In other words, since there have been subsidies to resident users in the past and since these subsidies are now being phased out, home telephone users are going to face telephone bills that are much higher.

If the whole thing proceeds according to a more optimistic scenario, you end up with a Bell Laboratories and a Western Electric and an AT&T that can compete successfully around the world in the computer market, in the telecommunications equipment market, as well as operating profitably in the domestic telecommunications services business.

Do you think American Bell, Inc. [recently renamed AT&T Information Systems, Inc.] is in trouble? And can you be specific in addressing American Bell and what its problems have been?

Yes, I do think that American Bell is in trouble.

The problems in the Bell System for the past 10 years in particular have included a lack of communication and a lack of organizational ability to get ideas from the marketing side into the form of product conceptions from the research end and then into the form of developed products that the marketing side can sell.

In other words, between 1973 and 1983, relatively little progress has been made in speeding up this process of developing products the marketplace actually wants within a time frame that allows them to put competitive products on the market.

How would you evaluate the American Bell's System 85, especially in light of its recent enhancements?

Let me answer that on two levels. First of all, on a technological level, the System 85 is a fully competitive, advance-function digital PBX. Perhaps it doesn't have everything that the other nonexistent advance-function digital PBXs such as Ztel, Inc.'s have, but it has most of what existing PBXs from Intecom, Inc., Rolm and Northern Telecom, Inc. have.

But on another level, of course, it doesn't exist.

What do you mean by that?

Well, the enhanced system won't be shipped to customers until next January and won't be in actual volume production for another year. From my understanding, the small-scale version of System 85 announced in January has been shipped only to a small handful of customers. Even though American Bell won't release any figures, it is my understanding that only 100 will be shipped by the end of December of this year, and we're talking about AT&T's first all-digital PBX.

Rolm and others handled digital PBXs as long ago as 1977 — which was six years ago. This points out how late AT&T is with this product as compared with other vendors. And if you look carefully at what was really announced, I think the major thing that came out of the announcements was a pricing concession to existing Dimension customers and to buyers of the small-scale System 85 that Western Electric can make in small numbers right now.

American Bell will waive the cancellation charges which, in typical cases, might amount to three months' rent for customers late in switching to the large-scale System 85. So they are really saying to the world, 'Look, we can't deliver substantial numbers of

> ***"The problems in the Bell System have included a lack of communication and a lack of organizational ability to get ideas from the marketing side into the form of product conceptions from the research end and then into the form of developed products that the marketing side can sell."***

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System 85 for another year. What we are going to do is raid the profitability of our installed base of Dimensions and borrow from the profitability of any Dimensions that we sell during the next 12 months.'

"For small configurations of people with a relatively small number of terminals, the flexibility and convenience of PBX is very attractive, so the PBX add-ons certainly make sense."

How practical are the PBX data add-on units such as those that are available for Northern Telecom's SL-1?

When you look at the economics of most of these things, they turn out to be considerably more than $1,000 and sometimes considerably more than $3,000 per data connection. So even though they work technologically, they are pretty expensive as compared with an Ethernet interface, for example.

This gets back to the point I was making before, which is that for small configurations of people with a relatively small number of terminals, the flexibility and convenience of PBX is very attractive, so the PBX add-ons certainly make sense.

Who is going to be managing the corporate communications function in the next 10 years and who is that person going to run into before getting to the point where he can manage that function? Or will he have to compromise and share the management of that function?

That's a good question, as also is the question of just what the managing function really entails. In most large companies today, we still have a basic structure that dates back 10 to 15 years.

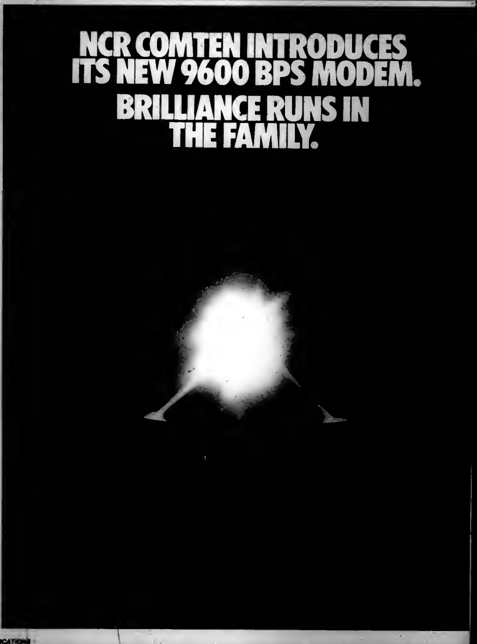
It involves having a [management information systems (MIS)/data processing] manager responsible for data processing and a completely separate person — called director of telecommunications or something like that — responsible for telecommunications. The latter reports to the former in only about half the cases. In the other cases, the telecommunications director might report to the vice-president of administration, whereas the data processing manager reports to the vice-president of finance.

In many of these companies, there is an interesting complication. When there is a manager of data communications, he may not report to the manager of telecommunications. He may, in fact, report to the manager of data processing because he is primarily supporting the DP manager's data communications needs.

Over the next 10 years, I think, you are not going to see a clear trend of success or failure. What you are going to see is a lot of corporate politics being played by the various people involved who are attempting to get control of the other person's empire — whatever that happens to be.

You mentioned 3270s and personal computers. What are the chances of one replacing the other and how does IBM view this whole thing?

That question is central to IBM's view of the world because the 3270s and their networks are in corporate accounts that collectively account for the majority of IBM's revenues. IBM's real revenue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> *"Mitel had a brilliant idea to design and build a bottom-end PBX that will sell for half the price of everybody else's. That's really the basis of Mitel's success to date."*

heartland is in the Fortune 1000 companies and the big systems that they have. IBM has a project code-named Rover. Some of the fruits of the Rover project were already announced by IBM in January in the form of flat panel display 3270 terminals and other things, too.

IBM also offers a Personal Computer upgrade in software to make it compatible with the 3270. And what we seem to be moving toward is a greatly enlarged 3270 environment in which the 3270 and SNA environment become the vehicle for a lot more things than for what the original 3270 was used.

If you look at what the early 3270s were used for, you find that the average 3270 terminal had a more or less full-time operator. That is, a person sat at that terminal all day and entered orders or entered other types of information or retrieved information or initiated insurance policies or did whatever the network was there to do. But networking was characterized typically by having almost full-time operators.

Over the past five years, we have seen an evolution toward networks expanding to the point where they don't have just full-time operators. They have 3270s sitting around that people can wander up to and punch in a query and get a response. The personal computer in the office of the future will be used in the same sort of mode as my calculator is. It will be used regularly, it will be relied on, but I will not be a personal computer operator any more than I am a calculator operator today.

Let me throw a few company names at you and you can just react to them. Mitel?

Mitel had a brilliant idea to design and build a bottom-end PBX that will sell for half the price of everybody else's. That's really the basis of Mitel's success to date.

When they have gone far afield from that, such as with the SX2000 larger PBX and perhaps also with the Contact workstation, it is less apparent that they have the organizational control over research and development, marketing and other activities to be confident of pulling off another great success. So I see Mitel as operating a somewhat risky environment.

How badly were they hurt by the IBM divorce?

Mitel was hurt by the SX2000 development problems which were what caused the IBM divorce. But the IBM divorce ended up easing matters for Mitel, because it had customers who were behind schedule receiving their SX2000s because they were all earmarked for IBM.

So they have not only had an unhappy IBM, they had 10 to 20 unhappy customers — all unhappy because the SX2000 software wasn't ready.

IBM's switch to Rolm actually allowed Mitel to take those SX2000s that they had on the floor and to reassign them to non-IBM customers who now end up getting their SX2000s at about the time they wanted them.

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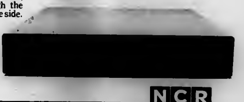

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And what about Xerox?

If you look at the decisions that IBM has made in the office automation and personal computer market in the past eight years, they seem to have had an uncanny knack for being right.

If you look at the decisions that Xerox has made in the same period of time, they seem to have had an uncanny knack for being wrong.

> ***"And if you look at the decisions that Xerox has made in the same time period, they seem to have had an uncanny knack for being wrong."***

Which decisions are you referring to?

I think you can point to the decisions in the copier area and in the local network area. But I think probably the 820 personal computer has been the biggest disappointment for Xerox in a market that is clearly exploding, where the leading vendor is far behind in filling orders. Orders are still outstripping IBM Personal Computer production.

Xerox is a company that has the marketing and maintenance capabilities few competitors can match, plus a knowledge of the office environment and knowledge of the individuals in most offices across the country. The 820 represented a great opportunity to ride the bandwagon of the personal computer.

For the want of a few decisions in the distribution of the software and engineering end, they blew it. So I think the 820 has to be pointed out as being Xerox's biggest disappointment.

What is the biggest misconception people have about communications and communications technology?

There are some major problems with teleconferencing that have neither been widely recognized nor resolved.

What are they?

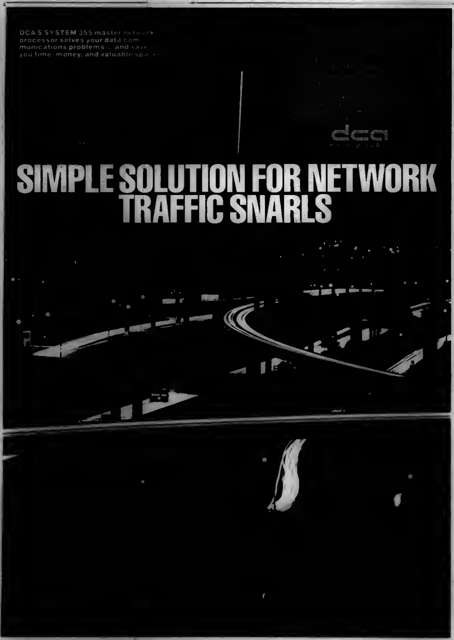
First of all, the symptoms of the problem are that teleconferencing does not necessarily end up accomplishing what the users of it want to accomplish. Second, the users don't want to use it again.

Now why is it that teleconferencing doesn't seem to work well and people don't seem to like to use it? That is extremely difficult to answer. There appear to be some things about teleconferencing that divert people from its purpose.

I am not talking about a fully rehearsed telepresentation. That works just fine. I am talking about telemeetings.

The problem with telemeetings appears to be related to the use of the TV-type screen. One of the conjectures that we've had is that people associate TV screens with a pattern of rehearsed, polished presentations. When they see real ordinary day-to-day people sucking their thumbs, picking their noses, not looking at the camera and so forth, they end up disassociating themselves with this idiot at the other end of the teleconference.

The teleconference brings them not closer together, but actually puts them further apart. This seems to be some element of that in some teleconferencing problems. There is no single answer as to what the problem is. ■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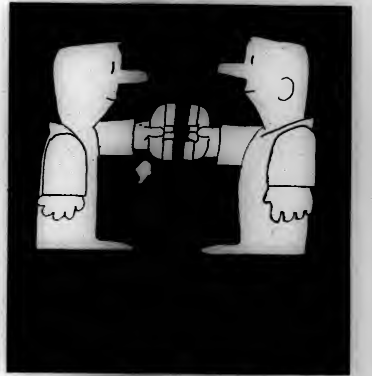

FOR SOUND TELECONFERENCING

BY LEE G. A. GRAHAM

The teleconferencing market is a growing part of the '80s. As the information revolution merges with the communications revolution, communications planners are becoming increasingly aware of a range of teleconferencing alternatives that runs from simple speakerphone to full-motion, satellite-transmitted video.

The middle part of this range is called audiographics. Audiographics combines graphics-oriented visuals with vocal teleconference facilities to provide the opportunity for enhanced, multisite dialogues.

Currently, audiographics configurations serve as a way station between audio and video teleconferencing. Advances in communications technology are gradually permitting the introduction of more cost-efficient and user-friendly systems. While waiting for affordable video, communications experts are introducing potential users to the concepts involved in teleconferencing, relying heavily on audiographics. This will pave the way for corporate-level video networking and will also filter down to the development of department-based or workstation-based audiographics teleconferencing capabilities.

Audiographics devices include facsimile, remote slide projectors, electronic blackboard devices and stop-action video. Each of these options provides certain end-user capabilities, but also has particular limitations. The ▶

potential end user should be concerned about user-friendliness, reliability and cost, as well as factors specifically related to effective teleconferencing. These include interactiveness, speed of transmission and ease of use in the conference room.

Audiographics devices include facsimile, remote slide projectors, electronic blackboard devices and stop-action video. For a number of years, facsimile has been available to transmit information written or printed on paper to other sites participating in a teleconference. These devices are being standardized for signal compatibility and are offering faster, sharper copies at the receive site.

Teleconferencers are using facsimile devices in several ways. Some companies place desktop or console facsimile devices alongside a conferencing table for hands-on access to a copier. This enables images to be transmitted among sites and then copied, either onto multiple sheets of paper for each conferee to hold or onto clear acetate sheets to be projected on a screen in each participating room at the same time.

One of the earlier digital facsimile networks was put together at the National Aeronautics and Space Administration using Rapicom, Inc. R100 consoles. During the final planning for the first space shuttle, graphics were transferred back and forth among scientists at the various space centers, easing the decision process needed for a successful mission.

Some users report that facsimile is too slow and noisy when located in the conference room to be used during the meeting. However, facsimile cannot be dismissed that easily. A state-of-the-art device such as the Rapicom 3100 desktop digital facsimile transceiver transmits standard pages of typewritten material to a remote location over unconditioned telephone lines or via satellite in 45 seconds. It uses digital compression technology and electrothermal printing to improve reproduction quality and costs about $4,500 per site.

The Consultative Committee on International Telephone and Telegraph (CCITT) has developed compatibility standards for facsimile devices in four groups. Group 1 devices transmit pages by FM analog modulation in four to six minutes. Group 2 devices use AM analog modulation and require two to three minutes. Group 3 devices use digital techniques and can take less than a minute to transmit. Group 4, still in the proposal stage, is intended for wideband transmission and has a resolution of 400 by 400 line/inch.

Several products are designed using Group 3 standards and have the option of interfacing with Group 1 or Group 2 devices. With the introduction of CCITT standards, facsimile is one of the standardized devices used in the field of teleconferencing. This allows users at all sites to fax back and forth without identical devices.

Facsimile also offers a direct link between the teleconference facility and the automated office. At the International Communications Association show last June, the major facsimile manufacturers, including Burroughs Corp., Rapicom and Panafax Corp., featured intelligently-enhanced devices that position them as contenders to handle burgeoning electronic mail requirements. Given the establishment of a digital facsimile network for electronic mail, the devices used in a teleconference facility can become part of the network. If this occurs, they will be able to transmit with more ease at 9,600 bit/sec and speed images among sites in roughly half the previous time.

The improvements in transmission time and quality, both for voice-grade or data network applications, allow facsimile to play a significant audiographics role in many teleconference facilities. However, the small size of the copies, the inability to transmit color and the complex maneuvers required for graphics interchange limit its effectiveness for some visually oriented conference room discussions.

IN ADDITION, SLIDE OR microfiche remote control devices allow conferees who want to discuss a series of predetermined visuals to recall them as needed at each site of a multipoint conference. Slide or microfiche remote control devices allow users at one site to guide teleconference participants at local and remote sites through a high-quality visual presentation. With the random-access feature, such systems offer flexibility in the presentation of predrafted visual enhancements.

Educational Technology, Inc. of Merrick, N.Y., offers the Telslide RSPC Interface. Through a standard voice bridge, this device allows a conference leader to control a random-access slide projector with an 80-slide tray at each site of a teleconference. With LED readout, on/off and advance/reverse controls and a touch-tone styled number pad, Telslide works in conjunction with a readily available type of telephone handset over dedicated or dial-up telephone lines. The device is

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priced at just under $900 per site.

This presentation mode is geared toward visual materials that have been prepared and distributed in advance. There can be no last-minute additions to what will be shown during the conference. However, the participants at each site have a control box and are able to take control of the slide access system during a portion of the conference. Thus, each speaker can randomly access the slides relevant to the point he wants to make.

THE ELECTRONIC blackboard allows real-time, interactive graphics writing. With some electronic blackboard devices, a number of screen pages can be predrafted and recalled quickly during a presentation. The writing can also be used to annotate a separately transmitted video image.

With electronic blackboard products, an image created at one site is condensed, transmitted and reconstituted at another site. The user at the second site can erase and add to the image seen on his monitor and send a condensed and reconstituted adjustment to the original user's monitor. The transmission of drawings and modifications occurs so fast that the interactive process is perceived as though the participants were seated side by side.

This type of real-time interactive capability is unique among audiographics options. With the tablet-based Telewriter II by Optel Communications, Inc. of New York, it is further enhanced through a series of 14 control buttons on the writing tablet. These provide users with the ability to switch between two colors, point or locate points on the monitor, erase selectively or clear the screen.

In addition, up to 15 pages of volatile memory can be stored, modified, destroyed, transmitted and recalled. This allows users to prepare visuals in advance. These can be modified by participants at all sites, until a final resolution is reached. A hard-copy printer and a permanent memory storage system are available with the system. The recently announced Voice, Too modem that allows the Telewriter II signals and voice to be multiplexed in one dial-up telephone line is also available. The basic system costs $9,120.

The electronic blackboard is not able to transmit any image that is not drawn by hand on its writing surface. In addition, because the remote site participants view what is drawn on a TV monitor of standard resolution, only limited amounts of visual information can be displayed. Optel addressed this problem by teaming the higher resolution Sony Profeel series monitor and 15 pages of quickly retrieved volatile memory. Thus, the number of screens of information and the amount per screen are maximized by using a small, portable writing tablet that can be passed among participants.

STOP-ACTION VIDEO equipment, also known as slow-scan or freeze-frame, permits the transmission of video camera images of documents or three-dimensional objects among sites. Depending on the system and the quality of resolution desired, the transmission takes from several seconds to a couple of minutes.

Stop-action video technologies offer users the opportunity to transmit conference-viewable video screen images of predrafted or currently prepared graphics. Subjects can range from microscopic to macroscopic, flat or three-dimensional, near or distant and color or black-and-white.

Colorado Video, Inc., one of the leading manufacturers of video equipment for teleconferencing, offers black-and-white and color slow-scan systems. The Model 285C Digital Slow Scan Transceiver provides the capability to transmit and receive color TV images over narrow-band communications channels using standard or special digital modems. At the transmission end, a single field or frame from a National Television Standard Code color television signal is grabbed and stored in the digital memory. When the operator is satisfied with the stored picture, he transmits to the other site where the picture can be scanned from left to right or from top to bottom. At the receive end, the picture is automatically received, stored and displayed on a color video monitor.

Per site, the Model 285 slow-scan equipment costs between $9,000 and $12,000 for black-and-white and between $11,000 and $14,000 for color. Fully equipped systems, including camera and monitors, cost between $10,000 and $15,000 for black-and-white and between $20,000 and $25,000 for color.

The major drawback to stop-action video is its lack of interactive capabilities. The viewer at one site who wants to propose modifications or point out a particular

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portion of the image must do so vocally. There is no hard copy to modify and retransmit. The transmission time factor also limits use. Knowing that an image may take a minute or more to set up and transmit, conferees decide to rely on verbal explanation, even though graphics would enhance and simplify the discussion.

An important concept in teleconferencing is the packaging of multicomponent facilities. Given the capabilities and limitations of each type of audiographics product, it is apparent that by teaming one product with another, users are able to compensate for one shortcoming with another strength.

The remote slide projector controller and facsimile are certainly complementary. Facsimile delivers black-and-white hard copy among sites at the last minute before a meeting, or even during the meeting if necessary. Anything that can be prepared and sent ahead of time is full-color screen viewable. This team of products is satisfactory for conference facilities in which the bulk of discussion revolves around presentation rather than illustrative interaction with iterations.

The electronic blackboard concept can be teamed with stop-action video for applications that require illustrative interaction. With an electronic blackboard, only information drawn by hand onto the writing surface can be transmitted. However, it can be transmitted and modified back and forth among sites. With stop-action video, any image that can be captured by a camera can be transmitted, but the users cannot climb into the photographs and use visual imagery to brainstorm back and forth about the problem being discussed.

If the graphics writing and camera images can be melted together on one screen, a medium is created in which give and take can occur about any camera-viewable, visually oriented business problem. The implications are powerful. Conferees are able to achieve the crucial ingredient that even full-motion studios lack — remote site access to hands-on illustrative interaction. This simply requires a stop-action video system and an electronic blackboard that is able to annotate video.

AT&T Information Systems, Inc.'s (formerly American Bell, Inc.) Gemini electronic blackboard does not have this capability, but others do. The Telewriter II is suited to annotate video images. The writing tablet and its electronic pen give conferees a familiar pen and paper medium with which to work. Participants remain seated as they write over the video image using the tablet and pen, so that the screen can be easily viewed by the other conferees.

When the time comes in the discussion to sketch a simple illustration of a point, the video image in the background can be turned off. The electronic blackboard is available as a stand-alone graphics writing tool. If the facility was equipped with stop-action video alone, such an illustration would have to be drawn out, placed before the camera and transmitted. If a user at the remote site wanted to suggest a modification, he would have to redraw the illustration from scratch or explain the modification in words. This lack of interactive capability has been cited in as a reason why slow-scan facilities have not been used as much as originally anticipated.

PLANNERS LOOKING into audiographics must consider many vendors and products. Given the various multiproduct permutations that are possible, some planners turn to one of the growing number of teleconferencing consultants. Consultants help users assess needs, select vendors and oversee installation of teleconference facilities. Although their services are not inexpensive, they can prove invaluable.

Some vendors and distributors package compatible products using a variety of referral and OEM agreements. However, users cannot depend on individual vendors to alert them to all of the attractive alternatives.

Video annotation is an example of the kind of multiproduct enhancement that an individual vendor might hesitate to introduce to clients. An architectural firm in Chicago recently installed teleconferencing facilities between its Chicago and New York offices and plans to use a freeze-frame video system.

The system includes an optional pointer generator that allows conferees to point with a white arrow to a specific location on the video monitors at both sites, in real time.

When the firm's consultants learned that Optel's Telewriter II had been modified so that it could annotate video, they informed the project team of this new alternative by sending literature on Telewriter II. The firm got in touch with Optel and discovered that Telewriter II could be used standalone to sketch back and forth,

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point to specific parts of video blueprints and draw proposed modifications, superimposed over the camera images of the blueprints. As a result, the architectural firm decided to replace the pointer with a Telewriter II system.

As the teleconferencing field continues to grow, users may want to count on consultants to inform them of new developments and alternatives.

The types of devices discussed above represent the range of audiographics options being actively pursued today. Each medium provides a viable alternative for presenting graphics information among multiple sites.

TOWARD THE end of the '80s, advances in technology will shift the primary focus in corporate conference facilities to full-motion video. Having spent the mid-'80s working with today's audio and audiographics devices, corporate users will have adjusted to the concept of teleconferencing as a legitimate means of transacting business. As a result, these users will be ready to accept the more sophisticated systems being introduced in the marketplace.

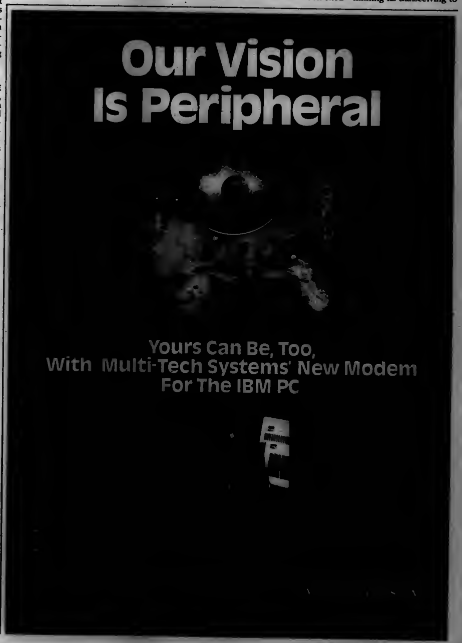
The role of audiographics will not be diminished. It will evolve to complement video networks and will be accepted in department-based and workstation-based conferences. There are several exciting events on the horizon that will greatly impact the audiographics market of tomorrow.

One development with wide ranging implications is AT&T's Network Services Complex (NSC), a network-based, high-quality bridging capability. To date, audioconferences that need to be bridged among more than two sites have been handled primarily by commercial bridging services such as the Kellogg Telephone Conferencing Service of Littleton, Colo. These bridges are capable of handling some audiographics devices that have a custom-designed protocol needed to go multipoint built into their modems. As the conferencing focus shifts towards graphics, it makes sense to have a bridge with a built-in protocol for graphics.

The NSC will have an audio bridge and a data bridge for multipoint voice conferencing, as well as CCITT Group 4 graphics conferencing. Both bridges are accessible from one dual-tone multifrequency telephone without the assistance of an operator. According to Bell Laboratories, any Group 4 graphics terminal will see the data bridge as another terminal, working with it as though connected point-to-point in a two-way data connection.

It is expected that Group 4 facsimile machines and several teleconferencing-oriented terminal products will use the bridge for multipoint (up to 60 ports) interactions at 4.8K bit/sec over the AT&T public telephone network or at 56K bit/sec via the circuit switched digital capability network. NSC promises to facilitate the introduction of faster, more varied audiographics devices into multipoint conferencing situations.

Another development of note is the upcoming introduction of near-live video at a transmission speed of 56K bit/sec. Widergren Communications, Inc. of San Jose, Calif., will introduce its VTC-56 two-way coder/decoder in early 1984, marketing primarily to the lower part of the Fortune 1000 and government agencies. Stop-action video has often been cited as inadequate for portraying people. Conference participants who fear being photographed in an unattractive pose are not at ease and cannot function in a fully productive manner. With full-color motion video deliverable on a 56K bit/sec data channel, audiographics shifts its role from the sole visual resource at a meeting to the more appropriate focus of graphics provider, limiting its transceiving to



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graphics and still-life documentation.

The introduction of 56K bit/sec motion video makes it more attractive for users to move from dial-up telephone linkage to high-speed data networks. Once that occurs, the parameters controlling several audiographics devices and their modes of transmission will change.

Given increased communications network capabilities, facsimile becomes a high-resolution graphics system, such as Rapicom's RHR-3. Used in the Intelmet Videoconferencing Service rooms — which began operating early this year between New York and London as a joint venture for Intercontinental Hotels Corp. and Comsat General Corp. — the Rapicom system provides the graphics component in a multicomponent facility. Given the broader band communications channel, the high-resolution, 1,024-line graphics are transmitted across the Atlantic Ocean in six to eight seconds.

The actual document scanner is designed to be inset in the conference table for user accessibility. A facsimile-to-video converter transposes the image data to high-resolution format, so that it can be immediately projected on a high-resolution screen for viewing and discussion.

Just as facsimile is able to graduate from 45 seconds to six seconds transmission time and from electrothermal paper to a high-resolution video projector, other audiographics devices will offer faster speeds and greater sophistication with the evolving communications network. They will take their places alongside full-motion videoconferencing devices, evolving to fulfill a newly appreciated role of graphics enhancement of video.

One final noteworthy development that affects the audiographics evolutionary process is the coming of age of executive workstations. These workstations are being designed in a variety of forms, each geared toward increasing the productivity of middle and upper management. Access to data, word processing, electronic mail and tools for analysis are all critical.

IN ADDITION, IT IS just as critical for executives to be able to interact visually and to brainstorm without stepping away from their workstation-based resources. Toward the end of the '80s, each of the audiographics options will evolve into a usable workstation format, taking its place as a provider of workstation conferencing capabilities.

It is almost impossible to predict how these developments will shape tomorrow's audiographics marketplace. High technology always has certain unpredictable variables. As with communications and information systems products, teleconference equipment can feature modular expandability as a safeguard against obsolescence.

The concept of teleconferencing promotes the cost efficiency, in terms of time and money, of interactive communications among several people at several locations. The various products available in the audiographics range take voice-only conferencing a step closer to being like a person-to-person meeting.

Distant participants who can look at the same image at the same time share more than words. They have an increased common ground for better understanding and productivity.

The factors that differ among audiographics products relate to what is presented, how fast it is transmitted and how easily it can be iterated. With teleconferencing goals specifically geared toward efficient participant viewing, real-time interaction and modular expandability will clearly be the leaders in the growing teleconferencing market. ■

Graham is a marketing consultant with Optel Communications, Inc., which is based in New York.

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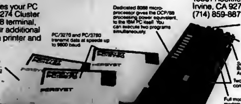
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AT&T: STARTING OVER

BY RONALD A. FRANK

As 1984 approaches, AT&T is working to implement the most radical change in its history. As the structure of the divested telephone company comes closer, business communications users are attempting to formulate a strategy to maintain their networks without interruption.

When new telephone company services were pending in the past, corporate customers often took a conservative wait-and-see attitude before making major network modifications. Today's user cannot afford to sit still. Contingency plans must be mapped ▶

out even in the face of imperfect information.

Telecommunications managers realize that the post-divestiture environment will require new ways of doing business. Many have decided to define a two-tiered operating plan. First, methods must be established to assure that existing levels of service are maintained. Second, new rates and options must be evaluated to take advantage of competitive services and avoid facilities that are no longer cost-effective.

Telecommunications staffs that operate national interstate networks face a major challenge. These users have often been designated as AT&T national accounts, and AT&T provided a single representative to resolve problems. The national account manager was an important contact for any Bell System problem. He was assigned to act as an interface between local Bell operating companies, the Long Lines Division (which has been succeeded by AT&T Communications) and other units that together provided end-to-end service to the customer. The national account chain of command helped many users maximize network uptime and limit service restoral delays.

> ***The operating companies think they have been cast adrift by AT&T. Even those that welcome their newfound independence realize that innovative offerings will be required to generate new revenue.***

The divestiture of the 22 Bell operating companies, together with the formation of seven regional holding companies, will change this. The various regulatory and legal decisions have made it clear that the independent operating companies must function at arms length from the surviving regulated AT&T long-distance company. The regional companies are working hard to establish individual identities. Such names as Nynex, Ameritech and U.S. West indicate more than just cosmetic changes. Each region seems determined to establish varied product lines and services.

AT&T has tried to blunt the emerging differences among the regions by setting up a Central Services Organization to oversee areas of common interest. But this organization will be funded by the operating companies, and its survival will depend on the budgets and business goals of the individual telephone companies.

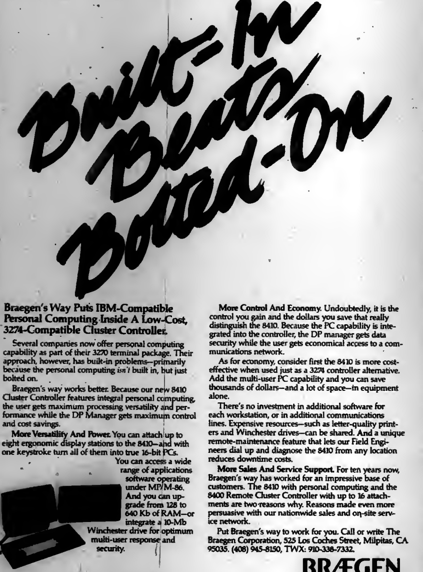
The operating companies think they have been cast adrift by AT&T. Even those that welcome their newfound independence realize that innovative offerings will be required to generate new revenue. In the past, the operating companies received a major share of AT&T revenue from long-distance calls. This money subsidized the local telephone companies and was disbursed under a complex formula. AT&T had convinced the Federal Communications Commission (FCC) and state regulatory commissions that the cash flow to the operating companies was needed to keep them in good shape. Regardless of the economic justification, the operating companies will lose this revenue stream. To make matters worse, all existing customer premises equipment installed at user sites will shift to AT&T Information Services, Inc. (formerly American Bell, Inc.), the AT&T unregulated company.

Amid all this churning and jockeying for position among 22 newly independent operating companies, it is questionable how much priority and uniformity can be expected in the area of network maintenance. Even if the telephone companies manage to maintain an effective service level, users will probably need to deal with several technical crews when trying to correct network malfunctions.

There is no easy solution to this problem. Several organizations have promised to provide centralized coordination functions to keep user networks operating. Both AT&T Communications and AT&T Information Systems have suggested that they may provide a type of facilities management service for large users.

However, most users are reluctant to give control of network management to an outside organization.

Many corporate telecommunications staffs are upgrading their in-house troubleshooting and diagnostic capabilities. At the same time, these staffs are taking steps to establish relationships with



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telephone company maintenance staffs in each geographic area where they have network facilities. In many cases, telecommunications managers must increase their budgets and staff size to take on these added responsibilities. This seems to be the most feasible strategy — at least for the immediate future.

If the network maintenance picture seems blurry, the equipment area is not much clearer. Present plans call for existing installed customer premises equipment to shift from local telephone companies to AT&T Information Systems. This so-called embedded base of equipment may be owned by AT&T Information Systems, but it seems likely that maintenance will continue to be provided by the operating companies under contract, since AT&T Information Systems has only limited equipment repair capabilities. Users will need to determine whether they call AT&T Information Systems or an independent operating company when equipment needs to be serviced.

Unfortunately, this relatively simple problem does not have an easy solution. It is complicated by operating companies' ability to offer their own customer equipment if they choose to do so. Some regional companies have already indicated that they will offer a range of equipment, including products from non-Bell suppliers. This could put the operating companies in competition with AT&T Information Systems.

If that were to happen, how would the equipment repair function be handled? It may be feasible for a residential customer to bring a malfunctioning telephone to a repair center. But what happens to a business user who needs ongoing service for telephones, data sets, terminals and a wide variety of devices installed at multiple sites?

Business users would like to have the option of purchasing their installed equipment at a pro rata cost. Thus far, this issue remains to be addressed by AT&T. Many users have considerable monthly charges for their telephone company equipment. The lease vs. buy decision will require extensive financial analysis, and users are seeking the necessary time to reach an objective decision.

The transfer of customer premises equipment from the operating company ownership to AT&T Information Systems actually deregulates the equipment to the competitive arena. It is necessary for AT&T to fix a value on this embedded base at the time of deregulation. AT&T has indicated that residential users will be able to buy their telephones, but a similar plan for business customers has not been announced.

Monthly telephone bills for business users will also change. The local divested telephone companies will bill for calls within the Local Access and Transport Area. Long-distance calls will be handed off to an interstate carrier chosen by the customer. Eventually, all long-distance carriers will be reached with a four-digit access code or a customer will be able to specify the same carrier for all calls. In any case, the long-distance component will become a separate item on the monthly bill even it it is sent in the same mailing by the local operating company.

At the same time, equipment will have to be broken out and charged as an individual item. In the past, AT&T provided a service that included both lines and equipment. By January 1984, embedded customer premises equipment will probably be billed by AT&T Information Systems, but the charge for lines will have to be broken out. In addition, the Bell operating companies have been given the approval to offer their own customer premises equipment.

These fragmented monthly bills could be a headache for telecommunications staffs. Many companies have instituted elaborate internal charge-back methods so that calls and equipment can be allocated to the using department. Many of the charge-back systems will have to be modified, but work on this task cannot begin until the users have actually seen what

Monthly telephone bills for business users will also change. The long-distance component will become a separate item on the monthly bill even it it is sent in the same mailing by the local company.

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their new bills will look like.

The issues outlined thus far are related to continued operation at predivestiture levels. Once the strategy for coping with the new environment has been implemented, users will need an approach for expansion and modification of their networks.

There is much talk these days about access charges. This is still a fluid area, and it is futile to speculate on added costs that might be faced by business users. It seems to be a foregone conclusion that local Bell operating company rates will increase to make up at least partially for the loss of long-distance revenue. At the same time, users have also been promised reductions in long-distance charges as a result of the AT&T reorganization. Few telecommunications managers are holding their breath for any dramatic drop in rates.

THE CRITICAL ISSUE posed by proposed access charges relates to alternative systems to replace the local loop. It may be cost-effective for larger users to install systems that bypass traditional telecommunications lines. The feasibility of bypass methods will depend on proven reliability of the technology being evaluated as well as the ultimate cost of conventional local loops. The issue is mired in politics, and there are proposals to assess some type of penalty charge to users who establish bypass systems. High-volume users who can justify bypass will probably not alter their decision because of a penalty fee. But until the rates are finalized, users can only evaluate bypass tentatively.

Expansion of network facilities is also a gray area. Significant tariff differences may exist among the seven regional companies or even between individual local operating companies. It is safe to say that uniform nationwide rates are no longer assured. This prospect, together with the service coordination difficulties outlined above, will undoubtedly cause users to look more closely at providers that offer end-to-end service.

However, there are some important qualifications. Users with large private line networks and associated large investments in equipment and network management tools will be hard pressed to cost justify such a major change. These users may be locked into an existing environment and will have to cope with the many telephone company organizations.

It is still unknown how aggressive the operating companies will become. In addition to providing equipment from a variety of suppliers, the divested local companies may offer specialized services aimed at business users. Nominally, the operating companies are prohibited from offering enhanced services with data processing or computation components.

BUT THIS IS ALSO A gray area, and the more dynamic operating companies will try to grab as much of the market as the regulators allow. Innovative telephone companies may decide to offer enhanced or value-added services such as electronic mail in cooperative arrangements with nonregulated suppliers. In this type of service partnership, the operating companies would provide the central office facilities and local distribution, while the outside provider would manage the enhanced portion. Such arrangements are speculative, but within the realm of possibility.

With the many unresolved issues, individual telecommunications managers must fashion a post-divestiture strategy that will implement corporate communications goals and cause minimal upheaval. It will take some time for answers to surface. There are few users who expect everything to be crystal clear on Jan. 2, 1984.

At the same time, telecommunications staffs are establishing lines of communication with evolving telephone company organizations. They are upgrading in-house network diagnostic systems so that all possible fault isolation can be done before carrier assistance is requested.

The telephone company has a good batting average when it comes to user support. It is doubtful that Bell operating company staffs want to tarnish the established Bell System image. But carrier and user alike are being swept up in a new environment. Users must take the steps needed to assure uninterrupted support and service. The user is paying for this in his monthly bill and has a right to require it.

Telecommunications managers are a hardy lot. They learned their profession by dealing with on-the-job problems as networks evolved into essential company resources. There is every reason to believe they will handle AT&T's restructuring in fine style. ■

Frank is managing director of Frank Communications Group, a telecommunications consulting firm in Mont Vernon, N.H.

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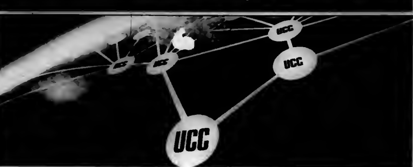

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TELEPORT

AN OFFICE PARK OFFERS SATELLITE SERVICES TO FIRMS FLEEING NEW YORK

BY BRUCE HOARD

NEW YORK — President Ronald Reagan labeled it "a great American achievement." Merrill Lynch & Co., Inc. Chairman Roger E. Birk referred to it as "a major step toward revitalizing the entire region." New York Gov. Mario Cuomo said, "It is impossible to calculate the implications of what we are doing today for the people of our state in the future."

Reagan spoke from Air Force One, Birk from lower Manhattan and Cuomo sent his comments via videotape. All three were tied in to Staten Island via teleconferencing links as part of ground breaking ceremonies in June for Teleport, the innovative satellite communications center and office park that is being constructed here.

Teleport is a joint venture of Merrill Lynch, Western Union Telegraph Co. and the Port Authority of New York and New Jersey. The $225-million, 200-acre project is being built to halt the flow of back-office computer operations from the prohibitively expensive rental real estate of Manhattan to more affordable digs outside the New York/New Jersey metropolitan area. Those back-office operations include secretarial and clerical staffs, CRT terminal operators, technicians and engineers.

Slated to begin services in April 1984, Teleport offers the fleeing firms the choice of moving their back-office operations to a building in the office park or remaining in ▶

BRUCE HOARD PHOTO

place and accessing Teleport via the redundant fiber-optic links tied to its 12 initial earth stations. Teleport office park tenants stand to save as much as 50% in rental costs by leaving Manhattan for Staten Island, according to Charles G. Seliga, manager of marketing and real estate development for the Port Authority of New York and New Jersey.

"The rental rates right now range in the area of $38 to $45 per square foot in lower Manhattan," he said. "When you get up to mid-Manhattan, you're in the $55 to $75 bracket." Older buildings that require additional investment to accommodate computer systems are somewhat less expensive, he said.

THE RENTAL rates at Teleport are considerably less, starting at about $20 per square foot, Seliga explained. "With Teleport, you get a custom-designed building, including a raised floor, and we're talking in the low 20s," he said. "That amount of money would be based on exactly how much of the building requires raised floors. If it's the whole building, you're up in the mid-20s range. So you are saving almost half."

The first fiber-optic links run along various rights-of-way the Port Authority maintains to the World Trade Center (operated by the Port Authority) in lower Manhattan, Journal Square in Jersey City, N.J., and the office complex here on Staten Island. Other links are planned for Hoboken, N.J., midtown Manhattan, Queens and Brooklyn.

How much fiber-optic cable is being used? "We've pulled 50 fibers between here to the World Trade Center and Journal Square," Stanley M. Welland, Merrill Lynch vice-president, strategic technology planning, said. "We probably will pull a similar amount between Journal Square and Staten Island."

He said the fiber-optic cable installed so far is multimode, while all future cable will be monomode. There is less attenuation and higher purity of fiber with monomode fiber-optic cable, and monomode also costs less and offers more potential bandwidth, Welland said.

The cables will provide circuits at speeds from 56K bit/sec and multiples of T-1 (1.544M bit/sec), to 45M bit/sec for video. Voice, data, facsimile and video services will be available. Teleport will also offer both its remote and office park clients terminal equipment for multiplexing and demultiplexing transmissions. Office park tenants will have access to a fiber-optic, cable-based local-area network connecting all the buildings in the park with earth station facilities. All operations will be controlled from the Telecenter, a centrally located building with advanced monitoring and diagnostic capabilities.

Users will have access to the 43 existing or planned domestic communications satellites and, if plans work out, to the European bank of the global International Telecommunications Satellite Organization communications satellite system. Toward that end, the Communications Satellite Corp. (Comsat) announced that it expects to file an application with the Federal Communications Commission (FCC) for the authority to build an earth station at Teleport.

According to Comsat, the station could be in service by late 1984, serving as a hub for wideband, digital satellite services between the U.S. and Europe.

The Port Authority and the city of New York are responsible for the development and infrastructure of the office park, which consists of 200 acres of office area and another 150 acres of fresh water wetlands that will be set aside as a park, Seliga said. The office area consists of two 100-acre lots, which will be implemented as Phase 1 and Phase 2. The land is

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owned by New York City, and the Port Authority is leasing the land just as it does with airports and piers. The city is guaranteed a net share of the revenue and tax payments. "We will be leasing the buildings and/or land to prospective clients, but the city will always be the master landlord," Seliga noted.

The Port Authority is kicking in $57 million to Phase 1, for which 10 to 13 building sites are tentatively planned. Merrill Lynch is adding $50 million, and the city of New York is adding another $20 million, largely for utilities. "Every utility that will be out there will be new," Seliga noted. The remainder of the $225 million slated for Phase 1 will come from private developers. The date for implementation of Phase 2 has not been set.

The Teleport idea germinated in 1977 when the Port Authority and the National Research Council did a joint study entitled *Telecommunications for Metropolitan Areas, Near-Term Needs and Opportunities.* In 1979, the two began to explore the idea with various carriers, broadcasters and high-technology vendors. Merrill Lynch got involved with Teleport after Comsat General Corp. investigated the feasibility of the project and decided not to pursue it with the Port Authority, Welland said. Welland spearheaded Merrill Lynch's participation in the Teleport effort.

"The concept was always to marry real estate and office park development with technology — the technology of communications and computers," Welland explained. "And what the Port Authority needed was a technology partner." That is where Merrill Lynch fit in.

IN THE SPRING OF 1982, a year after Welland joined Merrill Lynch, the company decided to go ahead on Teleport and began searching for a communications partner. That partner turned out to be Western Union. Welland cited Western Union's "engineering excellence" and the large number of satellite transponders in use at the time as reasons for the selection. "It seemed to be a perfect harmony and synergy between the folks at Merrill Lynch and Western Union," Welland said.

The two companies have since formed Teleport Communications, which has an agreement with the Port Authority and New York City to manage the project. Teleport Communications will have the permanent role of coordinating the daily operation of the earth station facilities, fiber-optic links and tenants' communications systems. It will also market Teleport to prospective clients.

Teleport will be extremely flexible in addressing the needs of its clients, providing three forms of access to earth stations: privately owned, shared or universal access. Several earth station slips and appropriate shielding will be available for users who want to build their own earth stations. Users may assume responsibility for earth station operation or pass it on to Teleport personnel. Users who opt for shared access gain exclusive use of earth stations and must establish their own operational procedures. Teleport, however, will be responsible for overall operation. In addition, Teleport will help organize shared-access users groups.

Universal users will be able to access earth stations on a dedicated or demand basis. On a dedicated basis, they will subscribe for a given amount of bandwidth access to one or more satellites. On a demand basis, they will request access to a specific satellite system during a specific time period using a given bandwidth.

Teleport users who establish offices in the office park have a number of flexible alternatives to consider. They may construct their own buildings, pay Teleport to build for them or rent space in

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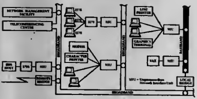

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According to Seliga, there will be a physical and electrical security system designed to satisfy the stringent demands of the financial and communications communities that will be among the prime Teleport clients. Physically, the area will be fenced in completely and accessible through a single entrance guarded 24 hours a day, seven days a week. The Port Authority will also deploy its own police force, which has bistate powers in both New York and New Jersey.

In addition, Teleport will do its own on-site electrical distribution, backing that with an uninterruptible power supply system. The primary source of power will be the New York State Grid System, but there will be a substantial backup source. Because the Port Authority is a bistate agency, it has access to Public Service Power from New Jersey and the Middle Atlantic Grid System in case the New York State Grid System goes down.

[redacted]

> ***"Nowhere in the U.S. is there that kind of backup," Seliga said. "And that is something that people have really jumped on as a major item in their decision-making process." Tenants also will have the option of installing emergency generators or their own uninterruptible power supply systems.***

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In addition to the financial community, there are two big market segments that will use the Teleport facilities, Welland said. The first is comprised of the broadcast networks such as ABC and NBC. Cable production firms such as Viacom International, Inc. and Showtime Entertainment are included in that category.

The second group includes the common carriers. According to Welland, Teleport will offer them an alternative to the earth stations they currently use, located as far as 60 miles from New York City. It will also provide them with an alternative to metropolitan microwave systems that have become increasingly congested with traffic. Port Authority chose the Staten Island site from a total of 29 evaluated because it is relatively free of the electromagnetic interference caused by that excessive communications traffic found in the greater New York City area.

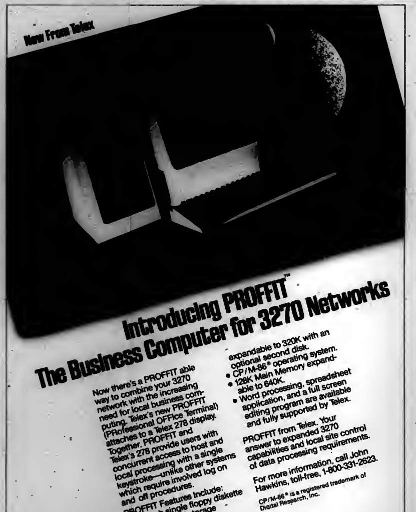
Teleport's location on Staten Island is optimal for satellite transmission. The facility will accommodate both C-band and K-band transmission. C-band satellites transmit in the 6-GHz range and receive at 4 GHz. They are prone to interference from other transmissions, often making it necessary to locate earth stations outside metropolitan areas.

According to Welland, C-band is a "nightmare" in most metropolitan areas. But because of Teleport's nearly electromagnetic interference-free Staten Island location, C-band will be the predominant mode of communications, he said.

"It looks like C-band makes the most sense," he explained. K-band satellites send in the 12-GHz range and receive at 14 GHz. They are not affected by competing signals, making them attractive for metropolitan use.

However, K-band also has its weaknesses. "K-band is terrific on a clear day, but even with a mild shower, you'd get a higher bit error rate but it would be survivable," Welland said. "But during a rainstorm, K-band has serious problems. Rain attentuates K-band transmission to the point where you just don't have a transmission."

Teleport will use the traditional single-beam satellite dish antenna, but Welland said there is a possibility of employing a multibeam alternative called Torus, which was developed by Comsat General. Torus addresses multiple satellites simultaneously. According to Welland, Torus technology is still in the trial-and-error stage. "The problem is, if you have to bring down a feed on a Torus beam antenna, potentially you're going to have to bring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down feeds associated with three satellites," he said "As a receive-only antenna, it certainly makes a lot of sense."

During Phase 1 implementation, 12 13-meter satellite dishes will be installed in Teleport's first berme, an area fenced in by earthen walls with steel reenforcement. The walls will be at least as high as the top of the tallest satellite dish, approximately 50-feet. The environmental impact statement governing the area allows for up to 17 dishes, meaning that another berme will house five more. A recent FCC ruling realigning allowable satellite positions means users will be gravitating toward larger earth dishes in order to access the more tightly bunched satellites.

Teleport has clearance to use the larger dishes, Welland noted. He also said Teleport Communications will own three of the initial 12 dishes and will provide universal access to them. The other nine will be located in slips available for lease to common carriers and other large users who can cost justify their own dedicated antenna slip.

According to Welland, most users cannot cost justify the expense of a dedicated earth station. He would not disclose how much Teleport is charging for the slips, saying only, "We are talking privately to people."

Seliga said the factors that figure into private earth station development include the size of the antenna and the amount of duct work necessary to connect electronics from the antenna to the Telecenter control building.

Welland used his own firm, Merrill Lynch, as an example, saying its domestic communications bill is $110 million to $120 million annually. "I think we might fill up two transponders, so for us to have our own earth station wouldn't make sense," he said. "Wouldn't it make more sense to sign an agreement with Teleport to provide the uplink/downlink facilities at Staten Island and bring in that service via fiber optics?"

Welland advised against leasing both transponders on the same satellites. He said Teleport gives satellite users more leverage in negotiating transponder deals with various common carriers. "You have the tough part of the problem answered — gaining the uplink access out of New York City," he said.

> ***"Wouldn't it make more sense to sign an agreement with Teleport to provide the uplink/downlink facilities at Staten Island and bring in that service via fiber optics?"***

Another tough part of the problem was getting New York City to provide the land for Teleport, according to Kenneth Lipper, deputy mayor of New York since January 1, 1983 and the city's pointman on Teleport. Before Lipper joined the city, the Port Authority presented New York with a proposal to buy the Teleport land. The city refused, claiming it wanted to keep the land. When Lipper — a former managing director at Salomon Brothers, Inc. and veteran negotiatior — joined Mayor Edward Koch's administration, he restarted the negotiations from scratch. "Teleport was one of the first problems that landed on my desk," he said.

With the new deputy mayor at the helm, the city hammered out a 40-year lease that would allow New York to hang on to

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Lipper's advice to other cities building similar communications centers is to protect their future rights, maintain veto power over participants and make money. "This is really a unique project," Lipper said. "When I look back at what we've accomplished over the past two years, it blows my mind."

the future ground rights in addition to a substantial profit. Lipper said the city felt Teleport did not need more than 100 acres for Phase 1, and that is what it got. "We share totally in all the proceeds of that," he said.

The city gets 50% in the form of taxes. Together, the city and Port Authority decided to lease 21 acres to Merrill Lynch for its own building, the Telecenter building and earth station bermes. Merrill Lynch also gets a declining tax abatement on the land, meaning it will not be paying full taxes immediately. The Port Authority and city also get 25% each of the profits of Teleport Communications, the joint Merrill Lynch-Western Union venture.

"Each of the items I pointed out in the negotiations was fiercely negotiated," Lipper said. "There were tremendous numbers of hours spent in intense negotiation on each of the points."

New York Telephone and cable television companies such as Warner Amex Satellite Entertainment Corp. also figured into Lipper's Teleport agenda. Although both Seliga and Weiland denied having any interest in offering telephone or cable television entertainment services, a spokesman for New York Telephone was less than certain, noting that Teleport is unregulated.

"We are not opposed to competition as long as we are permitted to compete on an equal basis," the spokesman said. "However, our understanding of Teleport is that it would be free to pick and choose customers with no obligation to serve all customers. We, on the other hand, are committed to serve all customers. Ours is a regulated environment. Theirs is an unregulated environment."

Richard Aurelio, senior vice-president of Warner Amex, was concerned that Teleport was getting unequal, unfair treatment by being allowed to branch into the New York boroughs of Brooklyn and Queens without yielding the franchise fee that cable television companies are required to pay.

Sounding a theme similar to that voiced by the New York Telephone spokesman, he said, "We are not scared of competition; we just don't feel we should be at a competitive disadvantage."

Lipper said neither New York Telephone nor Warner Amex have anything to worry about. According to the deputy mayor, Teleport is prohibited from offering services to individual residences or hotels by the contract agreed to with the city. This effectively eliminates any threat to telephone and cable companies.

As far as the franchise fee is concerned, the city's law department determined that Teleport is a common carrier because of its affiliation with Western Union and thus not subject to the fee, Lipper said.

Furthermore, Lipper said the cable television companies are actually getting a better deal than Teleport because their franchise fee is based on profits as opposed to gross receipts. He even suggested that Teleport, New York Telephone and Warner Amex should work together.

"You're in the wrong pew," the deputy mayor recalled telling the telephone and cable representatives. "You should be sitting down with the Teleport people."

Lipper's advice to other cities building similar communications centers is to protect their future rights, maintain veto power over participants and make money.

Other cities that might heed that advice as they move toward centers of their own include San Francisco, Dallas, Chicago, London and Columbus, Ohio. But according to Welland, none of them will be the equal of New York's Teleport.

"This is really a unique project," Lipper said. "When I look back at what we've accomplished over the past two years, it blows my mind." ■

Hoard is editor of Computerworld On Communications.

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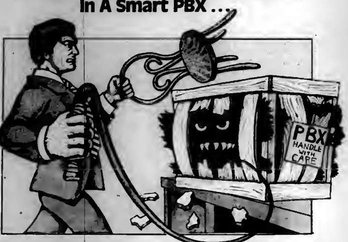

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MANAGING THE COMMUNICATIONS MENAGERIE

BY THOMAS ARMSTRONG

Network management is becoming increasingly difficult due to more sophisticated user requirements and demands. The growing complexity of networks, both in size and equipment types, and the numerous new network types that are becoming available and economically attractive are making the network manager's job much more taxing.

Today's communications network management systems attempt to provide the network manager with an advanced set of tools to perform the network management task, which includes performance assessment, fault isolation, restoral, configuration control and system performance analysis.

The network manager encompasses three viewpoints regarding network management: teleprocessing, data processing and corporate management. Historically, teleprocessing management has been concerned with the technical performance of the communications media and communications devices. DP management has been concerned with the performance of the terminal or DP hardware and software. Corporate management has been concerned with satisfying user requirements and cost.

The goals of a network management system are simple in concept and few in number. The first goal is to enable the manager to operate the network so that users receive satisfactory service. These users may be people, mechanical machines or computers. The level of service may be line/min printed, char./hour transmitted or simply operator response time. Operating ▶

the network to satisfy the users implies measuring network performance in-service, detecting outages or degraded conditions in a timely manner and isolating the fault to a specific vendor so system performance may be restored in minimal time. The ability to isolate the fault cannot be overemphasized.

If a fault in the system is known to exist, it may be necessary to provide a method of temporary system restoral while the fault is being corrected. Typical restoral actions include hot standby modem substitution, stream-disabling a terminal controller or providing an analog, dial line backup of an out-of-service digital link.

Another important goal is to minimize system operating costs. As defined here, this goal emphasizes minimizing the number of skilled and unskilled employees required to maintain system operation and provide required system expansion. This definition is in contrast to emphasizing the costs of equipment and communications services, which are key in minimizing the cost of operations as considered in the initial system design and configuration.

The emphasis on providing adequate historical data on network performance has recently increased. This data has numerous uses, from providing information on vendor equipment performance to enabling the system designer to provide for planned system expansion.

Finally, the management system must physically provide or allow system growth. This growth may be simply expanding the geographical area or the number of users. However, it may be complex, enabling different types of data traffic or communications links such as digital to be accommodated.

In order to understand future networks and network management system trends, it is worthwhile to explore the historical development of networks over the past decade.

Networks of the early '70s were largely composed of point-to-point telephone line circuits between two users or user groups at different locations. Management was simple, since only two locations were involved and all components of the network were connected in a series. Failure of any component caused complete system failure. Network management systems of this era were characterized by the ability to monitor only point-to-point circuits, manual test equipment, lack of predictive diagnostics and out-of-service testing.

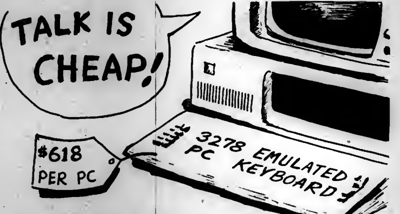
In the late '70s, networks became more complex and topologically involved, consisting of point-to-point circuits with time-division multiplexers or statistical multiplexers, point-to-point circuits with tail circuits, multipoint circuits and even loop and multipoint with loop circuits. In addition, the transmission speed increased, and 9,600 bit/sec point-to-point and 4,800 bit/sec multipoint were common.

THE EARLY '80S WERE characterized by the emergence of digital backbone circuits, 14.4K bit/sec point-to-point and true 9,600 bit/sec multipoint circuits. In the DP area, distributed processors and remote concentrators appeared. The geographical area of networks expanded, the total complexity of the networks multiplied and the data rates were substantially increased. As a result, user dependency on the network increased.

Today, another level of network complexity has been added: the digital service offerings, such as the satellite systems of Satellite Business Systems (SBS) or the terrestrial Dataphone Digital Service (DDS) offered by AT&T. These digital offerings introduce another set of management problems. The digital service vendor assumes responsibility for conveying data between locations, while the analog media vendor only assumes responsibility for providing the communications media (see figure on Page 83).

To accommodate the complex configurations and more stringent user demands, current network management systems are characterized by automated in-service testing, diagnostic test intelligence in communications devices, central diagnostic or network management processors, performance assessment and predictive trending. The 1970 test methods of nonpredictive diagnostics, manual testing and taking the system out of service for testing are no longer satisfactory.

The current trend is clear: Networks are becoming more complex, both in geographical expanse and in topology. Different equipment types are employed within a network. A large network may be composed of numerous smaller networks, each having different equipment types configured in different topologies. Therefore, a network management system must accommodate all the current requirements, and it must provide for future system growth in terms of network size



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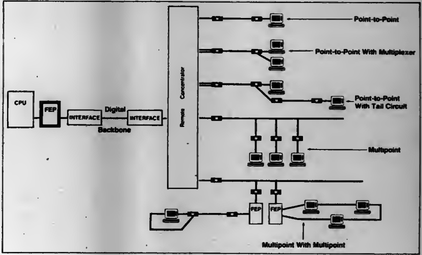
and new communications systems.

Future communications networks will incorporate new topologies, communications media, communications equipment and terminal devices. The medium employed may be radio, microwave, satellite relay, fiber-optic or dedicated cable in addition to the currently available twisted pair of the telephone plant.

More use will be made of packet networks, digital backbones, high-speed loops, bidirectional baseband cable, bidirectional and unidirectional broadband cable, private branch exchanges (PBXs) and voice and data PBXs. Voice, video and data will be mixed on the same network, and many new gateways will be employed for noncompatible network interconnectors.

In addition to involving many different types of data traffic, communications media and communications devices, future networks will involve different protocols. These include asynchronous, X.25 and IBM's Binary Synchronous Communications, Synchronous Data Link Control and High-Level Data Link Control.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Point-to-Point With Multiplexer
CPU
FEP
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Digital
Backbone
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Remote Concentrator
Point-to-Point With Tail Circuit
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Tail Circuits With Digital Backbone

Another trend that impacts the design of a communications network and the selection of a suitable management system is the increasing cost of network operation — not in communications costs, but in the cost of operations personnel. The cost per bit has been decreasing and will continue to decrease — particularly in light of the digital offerings and also the decrease in wire-line modem costs of the last few years. On the other hand, the cost of installation maintenance and clerical and system design personnel has been rapidly increasing. Users can look forward to many changes in network management. Individual aspects are discussed in detail below.

- *Host data links.* Greater emphasis will be placed on the use of data links between the network management system and the host processor. Applications residing in the host will access the network

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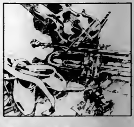

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management system data base to bring data into applications operating under the network communications control facility, for example, or for the generation of network performance reports. These host links will ease the network manager's task by reducing the number of application programs that must be developed for network performance, analysis and tracking.

- *Multiplexer diagnostics.* Multiplexer diagnostics will be integrated into the network management system in two areas. Multiplexer diagnostic ports will be tied into the system so that it can monitor and change multiplexer operating modes, monitor buffer levels and so on. In addition, data traffic parameters will be transmitted from the multiplexer to the network management system. These additional traffic parameters will be used by the network management system and the host to access the network status in-service with live traffic. They will also be used to compile detailed statistics on the multiplexer port traffic.
- *Digital service unit diagnostics, control and restoral.* DDS links are being integrated into teleprocessing networks when they can be cost-justified. The high-speed links (9,600 bit/sec to 56K bit/sec) are usually point-to-point. The lower speed links (2,400 bit/sec to 9,600 bit/sec) may be either multiport or point-to-point. In either case, digital diagnostic control and restoral is justified.

The former case has a high data volume, while the latter has a complex configuration analogous to a voice-grade line multiport network. Diagnostics and control in the form of digital service unit, Electronic Industries Association monitoring, loopbacks and anti-streaming are required. When 9,600 bit/sec single-call, dial, full-duplex modems are available, they may be used as a convenient restoral method for lower speed DDS links.

- *Generalized digital data service diagnostics.* Digital offerings from vendors such as RCA Globcom Systems, Inc., SBS and AT&T that do not require a digital service unit must be monitored by the network management system. The data rates may range from 56K or 64K bit/sec to as high as 1.544M bit/sec. For these situations, network management system vendors will provide a generalized digital monitor unit. This unit will provide digital link diagnostics and control based purely on the digital bit stream. This is in contrast with digital service units that rely on the network to convey diagnostic and some control information. These units will also compute network operational characteristics, such as availability and bit error rate.
- *Expanded digital service unit, digital monitor unit functions.* Expanded digital service units or digital monitor units will relay network management system commands and data between the network management system console and remote network management system concentrators. Such concentrators will be employed in systems where multipoint or point-to-point tail circuits are remoted from the host or front-end processor by a digital backbone. The requirement for diagnostics and control of these tail circuits is even more critical than if the master modems were co-located with the network management system console.
- *Increased automated restoral.* With increasing network complexity and personnel costs, more reliance will be placed on automating the network restoral functions. In addition to the current automatic restoral function of anti-streaming and dial call backup, functions such as standby substitution, alternate routing, speed change and multiplexer reconfiguration will be added.
- *Decentralized network control/centralized management.* As the geographical expanse and topological complexity of networks increase, network management system consoles will have to be distributed throughout the network so each console manages a

> ***More reliance will be placed on automating the network restoral functions. In addition to the current automatic restoral function of anti-streaming and dial call backup, functions such as standby substitution, alternate routing, speed change and multiplexer reconfiguration will be added.***

geographical area or particular subsystem. At the same time, ultimate central control responsibility is still required. This central network management system site is the location of the DP or teleprocessing manager. It may be used for total system control and monitoring during nonpeak traffic hours.

- *Increased use of color and graphics.* Color will be explored to make future management systems more operator-friendly and to increase operator efficiency. Inexpensive, high-resolution displays will permit the use of detailed network graphics for fault isolation. The graphics of network connectivity and equipment types will permit the operator to page through the network from the top level to lower levels, simultaneously performing tests from the same console to pinpoint a fault to the location, piece of equipment, vendor and service telephone number.
- *Limited dial circuit diagnostics.* Network management systems are currently tailored for the management of leased or dedicated physical data circuits. The use of dial-up telephone circuits will rapidly increase — particularly as 4,800 bit/sec and 9,600 bit/sec full-duplex dial become realities. Dial call diagnostics, with special emphasis on dial-out, will become valuable.

Diagnostics may be relatively simple, including Data Terminal Ready status of OFF or ON, remote modem self-test, remote telephone company loop status, local trunk status and local dialer status.

- *Emphasis on network management system traffic analysis.* With network management system diagnostics being extended to more teleprocessing equipment, more data traffic statistical analysis may be performed by the system. Increased detail in data traffic analysis will permit the management system operator to obtain better access and track the performance of the network as observed by the users. It will also provide a more solid foundation of information that can be used when reconfiguring the network or designing a new one.
- *Special application programs.* More special application programs for use by the network manager will appear. These may include network cost tracking or financial network analysis, network configuration at minimum cost and vendor availability tracking.

These applications will be provided by the network management system vendors and will reside in the management system central processor.

- *Data security control.* While the DP or teleprocessing manager may not have ultimate responsibility for data security within the network, the control and monitoring of security devices such as encryptors or authenticators must be a part of the network management system function. This is mandatory for two reasons. First, the security devices are always in series with the communications links and terminals. Second, in the future, security devices will be incorporated into communications devices such as modems and digital service units.
- *Logical circuit connectivity monitoring.* In the past, network management systems have provided only the physical circuit connectivity to the network management system operator. With the increasing use of multiplexers, automatic circuit patch equipment, packet networks, switching nodes, intelligent concentrators, voice and data integration, local networks and digital PBXs, it is necessary to monitor the logical connections of a digital voice or digital data traffic circuit. In the future networks, these logical connections will be constantly changing. Knowledge of the logical connections, in addition to the physical connections, will be necessary for performance tracking and for fault isolation.
- *Integration of digital PBX management.* Digital PBXs will become part of many voice and data networks. As a result, the management and data collection function must be extended to these as well.

Typical management functions will be monitoring PBX status, monitoring and controlling PBX connectivity of data circuits and extracting voice and data traffic statistics from the PBX. The above functions also apply to many of the emerging local-area nets.

- *Value-added network monitoring.* Network management system functions will be extended to value-added network management. These functions will be included in packet assembly/disassembly units. The network management system may actually keep a packet account to verify billing charges.

While all the future network management system characteristics mentioned above will not apply to all teleprocessing networks, it is hoped that network managers and designers will consider them when selecting or expanding a management system. Some of these trends may be added to the checklist that is used when comparing management system vendors. ■

Armstrong is director of product planning for Paradyne Corp. in Largo, Fla.

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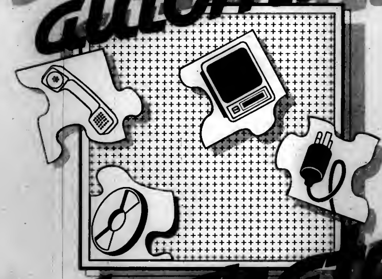

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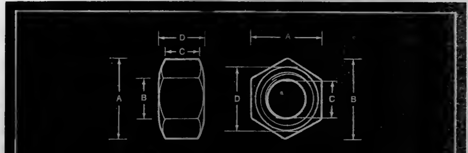


ILLUSTRATION BY HENRY FUNG

BY CRAIG JOHNSON AND GERALD BRINDA

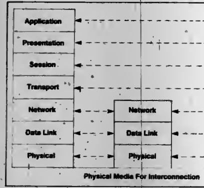
Network architectures are playing an increasingly vital role for users and suppliers of information processing systems as networks rapidly become the focal point of information systems and a key corporate resource.

The increased importance and complexity of networks demand that a structured and incremental approach be used to design, implement and evolve them. Network architecture can provide this, benefiting both users and suppliers of information systems.

Network architecture is the formal and rigorous process of network design. It concentrates on external interfaces between major network elements, consists of multiple levels of detail and can be open or closed.

A network, in theory, is a collection of nodes and links that communicate by a defined set of formats and protocols and are managed by a common set of controls. It is a complex system that must evolve over time to meet the expanding and differing reqirements of users. As with any other complex system, a network must be properly designed.

An open network architecture, such as the International Standards Organization's (ISO) forthcoming Open Systems Interconnection (OSI) model, is a technology that is readily available to anyone wishing to use it. In contrast, a closed architecture is a proprietary technology usually developed by a supplier for the interconnection of its own products. Occasionally, a closed architecture can gain such widespread acceptance that it becomes a de facto industry standard. IBM's ▶



OSI Architectural Layers

Systems Network Architecture is an example of such a technology.

As a set of design documents, network architecture contains several levels of detail. First, it contains an overview of the network. This describes the various functions of the network, the key parts (or layers) of the network and the distribution of functions among the parts. The overview also identifies the points or interfaces within the network that are designed in more detail. This can include formats and protocols across links; human interfaces such as command languages, ergonomics and definition languages; and adjacent (internal) interfaces such as application interfaces and physical media interfaces. The figure on the left shows an overview of the seven architectural layers associated with OSI.

The process used by suppliers to develop network architecture can be beneficial to users. First, network designs are usually more thoroughly verified. This consists of general design verification, for example, in ensuring a proper distribution of functions for performance and cost purposes. It also involves verification of the detailed logic contained within interface specifications. Such techniques as discrete and analytic simulation modeling and executable specification languages represent the state of the art.

Second, products are generally more thoroughly tested by the use of test vehicles. Test vehicles ensure that a product conforms to the architecture and will connect properly into the network. Third, the architects advise product developers and users in configuring networks and developing and testing architected interfaces.

Network architecture is not a product. It is, in fact, product-independent. That is, many different products can implement the design specified by network architecture in different ways and still conform to the architecture. In addition, a proper architecture is not static or stagnant. It evolves over time to meet the expanding requirements of the system and to reflect advances in technology.

In retrospect, the purpose of early networks (1955-65) was to allow terminals to access remotely central computer systems. This was usually hard to justify economically since terminals were connected on expensive dedicated lines to a single application. As a consequence, only critical applications or users could be accommodated.

Later networks (1965-75) improved interactive processing with teleprocessing monitors and time-sharing and began to support remote job entry for batch jobs. The main emphasis, however, was the computing center. Teleprocessing was perceived as the means to gain convenient — and sometimes inconvenient — remote access.

Current data networks (1975-85) use distributed processing to optimize communications functions, such as line costs and response time, and to provide additional features and applications to users. Remote concentration trades processor cycles for line costs, and application selection allows users to sign on to multiple applications from a single terminal. Distributed applications and data bases allow users to process locally, with the option to access remote locations on an exception basis.

Concurrent with the evolution of the data network, users have evolved a parallel network to handle voice communications. The voice and data networks converge only occasionally when trunk lines are shared and to handle dial-up terminals. This results in a segregation of functions and equipment from a user point of view and increased costs due to

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A number of economic and social factors will influence future networks (1985-2000). First, as processing costs decrease and organizations become increasingly distributed and concerned with worker productivity, the emphasis will shift toward personal computing. Computing resources, whether large or small, will be regarded as an extension of the activities of the individual worker.

Second, networks will continue to increase in complexity. As new products eliminate the barriers between the various technologies — data, image, voice and text — and as communications suppliers provide an increasing array of services in the wake of deregulation and expanding technology, the corporate network must expand to meet needs in a cost-effective manner.

In addition, most users will need to support multiple architectures concurrently within their networks. Each individual set of products associated with an architecture might solve a particular system need. When combined in the network, however, they are incompatible. As a result, gateways will be required to access between incompatible systems and to share common network resources.

Because of these trends, the corporate network is rapidly becoming the focal point of the information system. It must accommodate the expanding needs, the new types of equipment, the interconnection of multiple data centers and the migration of existing products and services. Data centers, satellite processors and terminal equipment are being perceived as end points that must connect to the network in a compatible manner.

In future networks, there will also be an increasing emphasis on cross-vendor compatibility. To this end, much work is being done within the standards community under the framework of the ISO's OSI. Various standards organizations, such as ISO, the Consultative Committee on International Telephone and Telegraph, the European Computer Manufacturers Association, the Institute of Electrical and Electronics Engineers, the American National Standards Institute and the National Bureau of Standards, are working with users and suppliers to define standards for open systems that can interconnect freely. In the future, users will demand this.

What is the reason behind network architecture? Quite simply, network architecture is the most cost-effective way to implement a coordinated set of products that can be interconnected. This can be beneficial to both users and suppliers. The following characteristics of network architecture exemplify this.

- *Separation of function.* As mentioned previously, user networks and vendor products must evolve over time to provide enhanced functions and accommodate the latest technology. With network architecture, the system is designed with a high degree of modularity so changes can occur incrementally and with a minimum of disruption. Key interfaces, such as application interfaces, and communications formats and protocols can remain constant, while transparent changes can occur internally within products.
- *Wider connectivity.* The goal of any corporate network is to provide optimum interconnection between any two end points, within the constraints of security. This general communications can only occur if the end points are compatible at all levels of the communications process, including physical, data link, end-to-end transport and application (end-user) levels.

From a supplier perspective, key interfaces within the architecture can be designed and used repeatedly by all products that must conform. This not only ensures compatibility, but also reduces development costs. From a user perspective, compatible products mean a simpler and less expensive network. There is less need to introduce gateways that translate between incompatible end points. While gateways may be required and desirable in some cases, they can require substantial resources, compromise function

Quite simply, network architecture is the most cost-effective way to implement a coordinated set of products that can be interconnected. This can be beneficial to both users and suppliers.

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and introduce added complexity.

- *Resource sharing.* Resource sharing is a technique to add functions and reduce costs with acceptable compromise in performance — for example, response time. Examples of resource sharing include multiple hosts sharing a communications processor, remote concentrators that multiplex data from several lines into a trunk line, terminals being able to select dynamically from a variety of applications and multifunction terminals that integrate voice, data and other forms of information.

The network architecture must consider these requirements as a fundamental part of the design.

- *Network management.* This is probably the most complex aspect of a network. From a supplier perspective, network management must be fundamental within the design, and it must apply to all products. It must be a common technology that allows flexibility in the degree of control and the methodology (centralized vs. decentralized). From a user perspective, the architecture must allow users to define, operate, change, maintain and secure the network effectively.

It must provide statistics for billing, tuning and tracking network resources and allow for evolution and reliable operation. As networks become increasingly complex, this process becomes much more difficult and potentially expensive.

- *Ease of use.* As networks become more widespread, affect more people and increase in complexity, it is essential that people be able to use and manage them easily. Ease of use is an important by-product of network architecture. Since network architecture is a rigorous design process, the technology underlying the network is formally documented and usually available to developers, support personnel and users alike. Since network architecture is a technology common to all products, it has broad applicability once it is understood.

Network architecture causes designers to focus on the key interfaces of the network and to design effective and easy to use interfaces from the outset. From a user's perspective, this means that key interfaces such as definition statements, operator commands, application interfaces and diagnostic protocols will be easy to learn and will also apply across several products.

Network architecture provides a rigorous and cost-effective way for the supplier to develop a set of compatible products, while giving the user better products that are less expensive, more compatible and easier to manage and use. ■

Brinda is manager of communications network architecture development, and Johnson is director of communications architecture for NCR Comten, Inc. in St. Paul, Minn.

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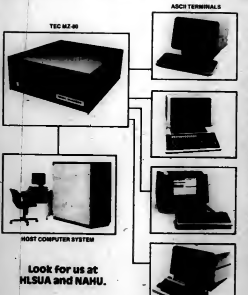

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The MZ-80 IMIU offers flexibility and power to users of all types of Honeywell computer systems that use VIP protocol. The MZ-80 provides a VIP-7700 compatible interface for up to 32 serial RS-232 devices such as CRTs, printers, Teletypes, etc. All devices share one synchronous line to the host, yet each device may have a different "personality" provided by driver programs in the IMIU.

IMIU software can also provide complete emulation of the VIP-7700 and compatible terminals such as the ITT-Courier 700 (including its functional extensions). This capability provides the Honeywell user with the features of the VIP-7700, using ASCII terminals costing substantially less. In this mode, up to 18 terminals are supported

IBM HOST SYSTEM ENVIRONMENT

The MZ-80 IMIU also offers cost and configuration advantages to users of IBM binary synchronous (Bi-sync) protocol. In this environment, the IMIU appears to be an IBM-3271 cluster controller using any of a large selection of less expensive ASCII terminals to emulate actual IBM-3270 terminals. IBM-328x compatible printers are also supported. In emulation mode, up to 28 devices are supported. IBM SNA/SDLC capability will be available in late 1983.

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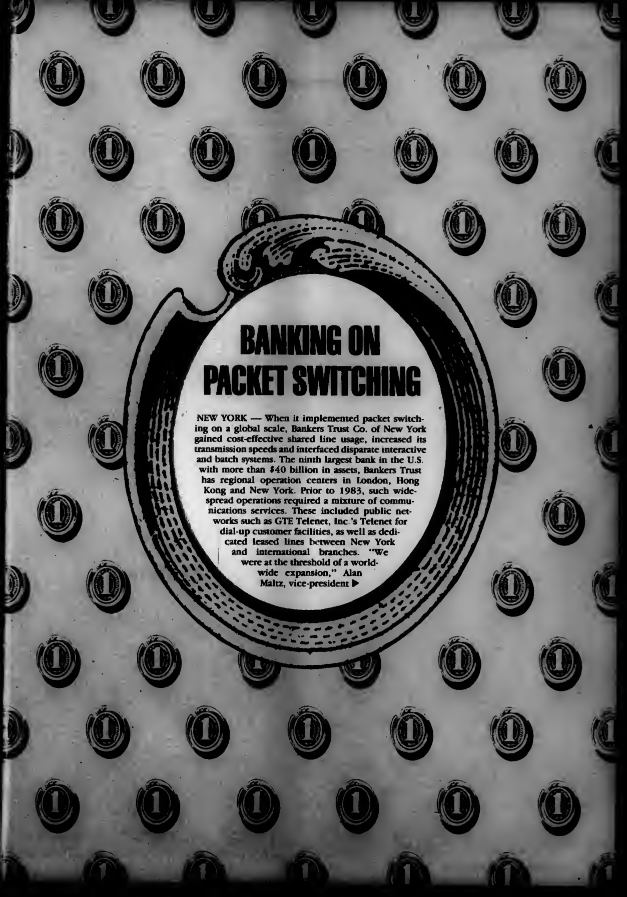

BANKING ON PACKET SWITCHING

NEW YORK — When it implemented packet switching on a global scale, Bankers Trust Co. of New York gained cost-effective shared line usage, increased its transmission speeds and interfaced disparate interactive and batch systems. The ninth largest bank in the U.S. with more than $40 billion in assets, Bankers Trust has regional operation centers in London, Hong Kong and New York. Prior to 1983, such widespread operations required a mixture of communications services. These included public networks such as GTE Telenet, Inc.'s Telenet for dial-up customer facilities, as well as dedicated leased lines between New York and international branches. "We were at the threshold of a worldwide expansion," Alan Maltz, vice-president ▶

of international telecommunications, explained. "We had a relatively limited number of international circuits to London. From there, lines spread out to Europe via statistical multiplexer data and point-to-point connections. The line costs within Europe were a couple of thousand dollars a month, so that was not unreasonable."

When Bankers Trust began to extend this concept to a worldwide system that included Asian locations, however, projected costs soared dramatically. "By bringing several circuits back to New York from locations in Asia and Latin America, we found that instead of $2,000 a month, we were paying in the $12,000 to $20,000 per month range," Maltz reported. "There was just no way we could afford to do that for each one of these locations."

According to Maltz, expense was only one of the major problems with this system. "Certainly, cost was prohibitive," he said. "For example, a single line between New York and Seoul, Korea, is $23,000 per month. But the second problem was that our network was totally inflexible. Each line was virtually dedicated to a single application.

"Two years ago, we undertook a major nine-month effort to define our communications requirements," he said. "This incorporated information supplied from top management and from people dealing with our communications activities on a daily basis.

"By extrapolating this information into the future, we could see that our data communications needs would be growing by 75% for the next several years. As a result, it was apparent that the associated expenses would be untenable unless a redesign of our international network was undertaken," Maltz said.

The bank evaluated the products of 11 vendors. The proposals included a Systems Network Architecture/Synchronous Data Link Control-type architecture proposed by IBM; Decnet by Digital Equipment Corp.; statistical multiplexing by Timeplex, Inc. and Infotron Systems Corp.; and packet-switching systems proposed by GTE Telenet, Tymnet, Inc., Amdahl Corp., Nippon Electric Co. Northern Telecom, Inc. and others.

"It was not an easy decision," Maltz explained, "because we anticipated that the basic network architecture we decided on would be in use for at least the next five years and probably well beyond that period." Thus, compatibility, flexibility, expandability and reliability, as well as cost, were critical factors.

It was evident to the Bankers Trust evaluation team that the best technical specifications may not perform in practice as well as they appear to perform on paper. Therefore, a major factor in the vendor evaluation was a proven track record. The evaluation team decided that Northern Telecom best satisfied these criteria. The firm's SL-10 packet switch was chosen as the backbone for the new Bankers Trust network. In addition, the remote packet assembler/disassembler was provided by Dynapac Co.

> ***It was evident to the Bankers Trust evaluation team that the best technical specifications may not perform in practice as well as they appear to perform on paper. A major factor in the vendor evaluation was a proven track record.***

This combination of vendors has proven extremely beneficial to Bankers Trust. "Northern Telecom's equipment was not the least expensive on the market," Maltz said, "but we felt comfortable with the company. We are a user of their SL-1 telephone equipment. Furthermore, Northern Telecom had all the financial backing and the research power to make it clear that they would be around for a long time. But most importantly, they offered a proven product. The SL-10 had been in operation since 1976 in Canada, and several networks were installed both in the U.S. and in Europe," he explained.

"We talked to Datapac — Bell Canada's public switching network," Dan W. Muecke, vice-president of international systems engineering, said. "We also talked to several other SL-10 users, including the Federal Reserve, a bank in Belgium and the Bundespost in

If you build your own data communications network, you have to maintain it yourself. And that means hours of planning, a big investment in capital equipment, dealing with vendors and the phone companies, providing ongoing testing and diagnostics, and making a lot of phone calls when a problem arises.

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West Germany. The installation and operation of these user systems went smoothly. This was crucial because we were seeking a fairly aggressive installation schedule.

"Our ultimate decision was based on the ability to deliver what was promised within specified time frames, coupled with a high degree of certainty that the vendor had staying power within the marketplace for the supply of long-term support and enhancements," Muecke said.

"Northern Telecom met our interface requirements," Joan Cho, assistant vice-president, network engineering, said. "We interface to Decsystem-2060s, PDP-11/70s and VAX-11/780s for our interactive processing, and the majority of our terminals outside of New York are Ascii terminals. Users in many foreign countries simply do not have 3270-compatible hardware," she continued.

The SL-10's flexibility was also a prime consideration, according to Muecke. "Our interactive systems tend to be DEC-based and our batched systems are IBM-based, so we needed flexibility between these two processors," he explained.

"Perhaps most important was that we knew DEC had already announced support of the CCITT X.25 international communications standard, and IBM had announced that they were moving toward support of X.25," he said.

"We feel that by adhering to an international standard, vendors will make equipment compatible with those standards. We will therefore be compatible with the world for many years," he said.

"In addition, X.25 is a more efficient interface for us than the individual asynchronous interfaces that would have been required with a statistical multiplexer approach. Again, this has proven to us the capability of the Dynapac and SL-10 equipment. Interface problems were minimal since each product adhered to the 1980 X.25 standard," Muecke pointed out.

Significant advantages currently available that were not part of the 1976 recommendation are increased flexibility through an additional five supported functions within the packet assembler/disassembler and an increased versatility in handling a wider array of situations.

The packet switch approach also promised to provide the desired cost-effective shared usage of lines. "Ascii data output from terminals can be converted into packets containing up to 256 characters," Muecke said.

"The packets are routed to the appropriate network destination. Sharing is possible during the time intervals between packets. While a terminal operator is typing or waiting, the line capacity is available for someone else to use. This is in direct contrast to traditional time-division multiplexers, where a given bandwidth is dedicated to a terminal, whether or not it is in use," he continued.

THE INSTALLATION of SL-10 in New York and Hong Kong was carried out as anticipated. "Everything went very smoothly," Cho said. "The switches were shipped on time. We established a schedule using the classic Pert chart, in the first part of September 1982. And we essentially met or beat all the critical milestones. Our biggest problems were in nonswitch-related areas. These included electricity, air conditioning and Pacific coast storms that affected the international circuits."

"We became operational on June 1st, 1983 — right on schedule," Muecke said. "When you consider that we selected Northern Telecom as the vendor in July 1982 and signed a contract as recently as just seven months prior to installation, that's really moving."

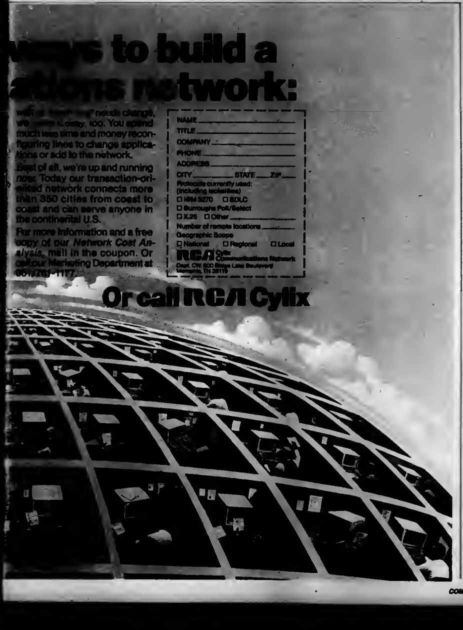
Start-up transmission rates were established at 40 million char./day, with significant growth potential. "Theoretically, we could transmit 15 billion char./day through one SL-10," Muecke said. "But if we eventually approach that volume, we'd simply split loads with more physical lines."

Although the majority of user terminal transmission speeds are in the 300 to 1,200 bit/sec range, and most Bankers Trust lines are 9,600 bit/sec, use of the SL-10's rated capacity of 56K bit/sec is anticipated within two years.

Expansion of the network to customer sites in Europe, the Far East, the Middle East, Latin America and Africa is expected during the next several years. "I envision a growth of several hundred percent over the next few years," Maltz said.

"This growth will be due to expansion of our customer services both in application scope and in geographic extent, and it may include the installation of a third SL-10 in London."

The result will be improved cash management for Bankers Trust customers and more efficient data communications services for Bankers Trust personnel worldwide — and Bankers Trust is banking on it. ■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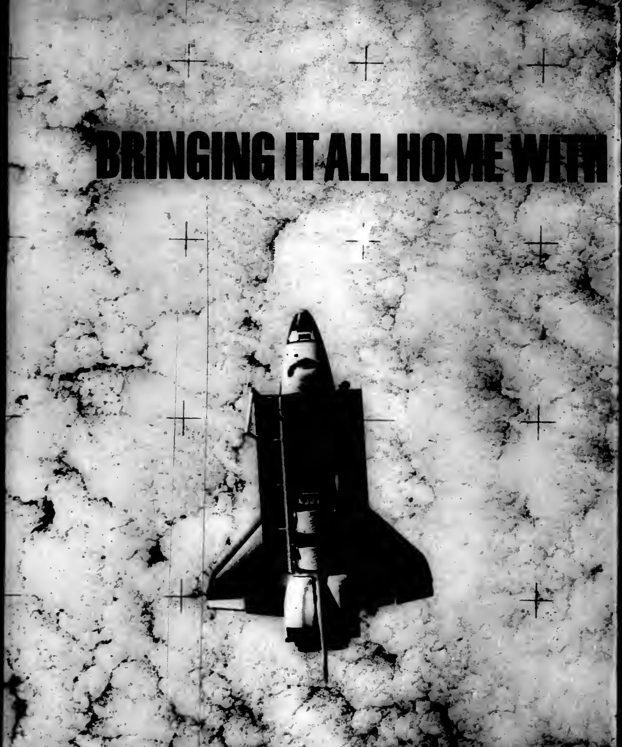

DIRECT BROADCAST SATELLITES

BY MICHELLE BROWNE

A new technology known as direct broadcast satellites is rekindling memories of the space race between the U.S. and the USSR. Several companies are striving to pioneer this new technology and bring it into the home. By now, many people are familiar with the large satellite dishes used by cable systems and owned by people who cannot get cable. The size of the dish relates inversely to the strength of the satellite signal: Present low-power satellites require 10- to 12-foot dishes. DBS technology, however, will use higher power satellites, so DBS dishes are expected to be much ▶

smaller, weighing 15 pounds or less and measuring from 18 inches to three feet across. As a result, homeowners will be able to install these dishes on their roofs, allowing them to sidestep the cable company and receive the satellite signals directly in their own home.

In addition, the companies currently planning DBS systems have agreed on common industry standards. A subscriber to one company's programming or service will have a dish compatible with every other service. Unlike the present state of affairs in the cable industry, with separate dishes needed to pick up signals from each of the satellites, DBS antennae will be able to pick up programming from every DBS.

Through a tiny chip in the receiver, even service providers that plan to scramble their signal and charge a fee will be available to the viewer who pays for the service. Upon requesting a pay service, the viewer's decoder will receive the signal to unscramble that signal. The dishes will be addressable, allowing the viewer to add or subtract services and to choose pay-per-view special events.

Because the small DBS dishes can be installed on viewers' roofs, DBS will bring video programs, audio and text services and electronic mail to areas both with and without cable TV, as well as to areas that are incapable of any television reception. An estimated two million to three million farms and ranches have no television of any kind because of remote or mountainous locations. For people in these locations, the investment in a satellite dish and its accompanying electronics may be well worth it. The average person with cable TV or traditional broadcast television will have to decide for himself whether DBS will be worthwhile.

The first high-power satellites will not be launched until 1986, but three companies have decided to speed up their plans and provide DBS service within the next few months, hoping to get a jump on some of the others. These companies — Satellite TV Corp. (STC), Interamerica Satellite Television and United Satellite Communications, Inc. (USCI) — are categorized as early-entry DBS providers, with plans to use medium-power satellites until 1986.

The medium-power satellites will require four- to seven-foot dishes in the Northeastern states, but will require larger dishes in some parts of the country. One medium-power satellite has already been launched, but it is aimed at Canada, and most of the U.S. is outside of its viewing area. As a result, many viewers will require a large 10- or 12-foot dish to receive its signals. While some early-entry companies claim that 48 states will be able to receive their programming, it is likely that those outside of the Northeast will have to purchase much larger dishes than the initial four-foot models.

Projections from some of the early-entry DBS companies slated to go into operation in late 1983 and 1984 put the first dishes in the four- to seven-foot range. Some companies' promises of smaller dishes using medium-power satellites are seen as far-fetched by such industry observers as Bob Fountain, who is vice-president of U.S. Satellite Broadcasting (USSB).

But this raises the question of practicality. The larger the dish, the more expensive it is. Dishes larger than two to three feet across are expected to put too much strain on the average roof. Wind and rain can cause problems with the stability of the dish and the roof, making it necessary to mount the dish in the yard. In many neighborhoods, homeowners object to the large unsightly dishes.

FOR THE FIRST FEW years that DBS is available, it is not likely that smaller dishes will provide a clear picture, according to John P. Taylor, DBS researcher and journalist. When the high-power satellites are in place in 1986, beaming their signals to all four time zones, the smaller, roof-mounted or pole-mounted dishes will become available.

"From my company's viewpoint, we look at early-entry with interest but not alarm," Fountain said. "Those companies are not going after the same market that we are.

"We're encouraged that a company like STC is going into it using the smaller dishes. It will move DBS small-dish technology several years ahead," Fountain said. STC plans to use 2½-foot dishes in its early-entry phase beginning in 1984 and aimed primarily at the Northeast. Of the two other early-entry companies, USCI expects to be the first company in business, with Interamerica entering the market soon after.

One problem with the three early-entry services is that they will emanate from different satellites, making it necessary to move the dish in order to watch other

services. When the DBS are launched in 1986, they will be closely positioned to allow dishes to pick up each service without being moved.

"DBS is an extraordinary efficient means of distribution," USSB's Fountain said. USSB is one of the eight companies currently licensed by the Federal Communications Commission (FCC) for construction of a direct broadcast system. USSB plans a nationwide service in 1986 with three channels of advertiser-supported programs.

The special services possible for direct home delivery will increase viewer interest in DBS. The possibility of using a satellite system instead of the post office for mail delivery is exciting to many companies eager to cut postage and rush charges for their time-sensitive material.

The special services possible for direct home delivery will increase viewer interest in DBS. "I think there will be some intriguing things available," Fountain said. "DBS represents an interesting marketing tool, useful for videoconferencing, data stream, teletext services, classifieds on a national level and even a teletext newspaper." The possibility of using a satellite system instead of the post office for mail delivery is exciting to many companies eager to cut postage and rush charges for their time-sensitive material. A report from a field office or thousands of mailgrams could be instantaneously beamed up to a satellite and transmitted back down to a printer at the receiving end.

The growing number of music, news and talk services available for audio and radio-type channels will add greater variety to the DBS dish owner's stereo listening. Services that might not garner a radio station of their own because of narrow audiences will offer everything from jazz fusion to Ukranian folk music. Since DBS services have the capacity for digital stereo, high-quality sound is expected. Stereo sound for video services is also expected to be a standard feature.

Perhaps the most burning question is: Will more of the same network and cable fare be shown on DBS systems? That is deemed highly likely by Taylor. "DBS programs aren't going to be very different from what you see on TV and cable every day," he said. Much of cable is similar to network fare because of the high cost of producing original programs and the scarcity of top-quality material.

One cable service reported to be set for STC's system is Cable News Network (CNN). CNN owner Ted Turner, who developed CNN and its counterpart, CNN-2, is eager to work with DBS as well as other means of distribution. While some services may be willing to go with DBS as a complement to their existing cable penetration, some DBS systems want to distinguish their product as something different from cable. Most are not giving specifics on what programs they will show.

Of the three companies planning to be in operation in 1983 and 1984, STC and USCI plan to offer movies, special events and a variety of sports, news and general interest programs. Interamerica plans to offer a service aimed at less populated areas of the country, with no specific programming announced. A fourth company, Oak Industries, recently decided to drop its early-entry plans and begin its DBS service in 1986.

The company with the most clearly articulated program format is USSB. Fountain said its three channels projected for 1986 will feature advertiser-supported, original programming. The first channel will have a format similar to a broadcast service, with soap operas, series, children's shows and movie features. The second channel will be an all-news service similar to CNN. These two channels will be free to anyone with a dish. The third will be a hybrid channel combining more cultural, educational programs aimed at special audiences in narrow demographic groups. Opera, photography, the arts and other subjects will be available, probably through a subscriber fee. Pay-per-view events such as major fights and first-run movies will also be available.

Other companies have DBS plans. CBS has announced plans for a high definition television (HDTV) service. Expected to give an extremely high-quality picture, HDTV is still in the development stage. RCA plans to decide within the next few months whether it

The promise fulfilled.

Others talk about integrating voice and data. Now with the NEAX 2400 Information Management System NEC makes it a reality.

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will continue in the DBS race or drop out. Originally, RCA planned to build DBS and lease or sell the transponders to programmers.

Oak Industries, which dropped its plans for early entry, plans a total of 12 channels by 1988, beginning in 1986 with two channels. The first will offer movies, major sporting events and special events, and the second will feature news, educational and local sports programs.

Satellite Syndicated Systems (SSS), which is not one of the original eight companies granted a license by the FCC, proposes programs including Broadway plays, ballet, opera, classical music events and foreign sports, movies and theater on a pay-per-view basis. SSS plans to wait until the ground has been broken for DBS and a base of viewers with dishes is in place.

SSS also plans to offer its electronic mail, teletext services and stereo audio channels. SSS currently operates audio music and talk services, a national teletext newspaper and several types of text services — from stock reports to commodities trading services.

Other companies with DBS applications or plans include Direct Broadcast Satellite Corp. and Video Satellite Systems. Some firms may plan to lease or resell their transponders to other companies with programs to offer.

DESPITE THE fact that DBS systems for the U.S. have been approved by the FCC, the FCC has not specified what regulatory status will apply. Different regulations will apply, depending on whether the companies planning to offer services are considered as broadcasters or common carriers. These two groups, which both provide programs via TV, cable and DBS, obey different rules and are allowed to charge different rates for their services.

There is a possibility that the FCC will adopt unique guidelines for DBS, distinguishing it from broadcast and cable. DBS companies wonder whether the Fairness Doctrine — requiring that broadcast stations allow both sides of an issue equal time on the air — will apply to them. Currently, cable stations are not bound by the Fairness Doctrine, and it is not certain whether DBS providers will be forced to adhere to it.

Several key questions were answered at the recent 1983 Regional Administrative Radio Conference in Geneva, Switzerland, which dealt with the question of how many channels U.S. companies would be allowed to develop. The conference included the countries in the Western Hemisphere, and the U.S. delegation was well-prepared, according to Fountain. It managed to get the go-ahead for up to 256 channels — more than enough to satisfy everyone.

Taylor predicted that DBS will replace cable and network TV's present distribution system, possibly by the year 2000. "There is very little question that the predicted 10- to 12-inch receivers will be technically possible — and I think they will be economically possible in the future," he said.

Whether the rosy picture painted by some companies will prove true or not remains to be seen. Informed observers are skeptical of immediate success for the new technology. The realities of DBS should become clear in the next few years as systems are built and companies take their baby to the American public. Whether the infant DBS industry is adopted or rejected will determine whether the rest of the companies will proceed with their plans. ■

Browne is a free-lance writer specializing in the cable TV industry. She is also public relations coordinator for Satellite Program Network in Tulsa, Okla.

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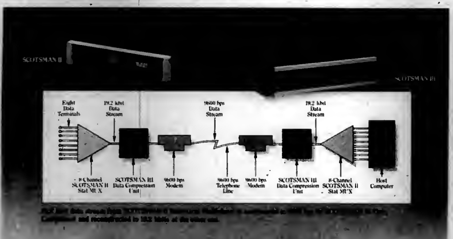

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GETTING PERSONAL WITH MICROCOMPUTER NETWORKS

Broad acceptance of microcomputers has generated a second wave of interest in expanding computing horizons through communications. As user interest in communications has expanded, so have the number of options available from vendors.

The first of three common topologies is simple point-to-point communications. Device A transmits an asynchronous, Ascii/TTY data stream through a modem across the line to a second modem connected to Device B. The Device A modem translates the data stream into an analog telephone signal. The modem at Device B demodulates that signal, turning the wave form back into digital information.

Typically, however, a basic microcomputer system does not include this kind of communications capability. Instead, it must be upgraded with an expansion board in order to talk to the ▶

BY TIM CAFFREY AND TOM WILLMOTT

outside world. In the case of the IBM Personal Computer, the user must install an asynchronous communications card in one of the system's expansion slots. A modem may then be attached to this port. In the near future, this communications capability can be expected to be integrated at the chip level.

Vendors such as Bizcomp, Inc. of Sunnyvale, Calif., are already offering 1,200 bit/sec modems on a single expansion card.

In addition to add-on hardware, communications is controlled by utility software routines. At the simplest level, a communications utility program enables the user to select a file from a diskette and to format it for transmission to a remote location.

The most common protocol is TTY, long established as an asynchronous protocol standard. Independent software houses offer a a wide variety of other packages that include more sophisticated error handling, data capture and file translation features. These programs are loaded into computer memory from the diskette.

In a second common situation, the microcomputer seeks information from a minicomputer or mainframe. This access is usually gained through a communications controller attached to the host processor to coordinate terminal activity. While it is possible to transfer files between the mainframe and micro, in most cases, the formats of the large system files are incompatible with the microcomputer files and, therefore, unusable.

Because of this incompatibility, current micro-to-mainframe communications usually involves the microcomputer simply emulating the capabilities of a large system terminal such as a Digital Equipment Corp. VT-100 or an IBM 3278. An obvious drawback to this arrangement is that the microcomputer must sacrifice local intelligence for terminal emulation during a working session.

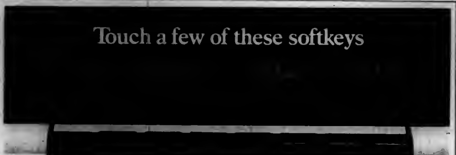
There are many hardware and software products designed to turn the microcomputer into a terminal. The final result of this transformation is that the microcomputer uses application programs such as payroll data entry and interactive data base query running on the large system. This multifunction workstation concept is growing in popularity.

A third possible network configuration is designed to provide shared resources in a local work group. Historically, the first networks of personal computers grew from the need to share access to expensive Winchester disk drives. It was difficult to cost justify a storage device that often sold for more than double the price of the microcomputer itself.

Corvus Systems, Inc. entered the market early with its first networking product, Constellation. This product uses multiplexing techniques and a star topology to share a multimegabyte Winchester. The multiplexer polls each microcomputer in a time sequence to assess demand for disk access. Although this technical strategy of multiplexing achieved the objective of sharing Winchester resources, it soon became clear that more power and flexibility were needed in certain office environments.

Recognizing the need for additional power and flexibility, Corvus has introduced several new products over the past few years. In addition to extending Winchester disk support to a number of additional vendors, Corvus also announced a new network, Omninet, and their own microcomputer, Concept, which is based on a Motorola, Inc. 68000 microprocessor and a bit-mapped, high-resolution CRT.

Another vendor offering microcomputer networking products in a star configuration is Novell Data Systems, Inc. of Orem, Utah. Novell's Sharenet uses a Network Manager designed around the Motorola 68000 microprocessor. Currently, it works in conjunction with IBM PC-DOS and Zilog, Inc. Z80 microcomputers running



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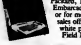

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the CP/M operating system. Each microcomputer is hooked to the network by a network interface card that fits into an expansion slot. Maximum distance between any micro and the Network Manager is 3,000 feet. Each network can support up to 24 micros.

Sharenet offers four major capabilities. The first of these provides access to a shared hard disk. The user may want to store files on a large capacity mass storage device. In addition, there are also times when two or more users may need access to the same file of information. Sharenet offers both mass storage and concurrent file sharing with information security options. This capability frees the user from the limitations of floppy disks and maximizes the availability of information for multiple network users.

With Sharenet, any two microcomputers can have point-to-point communications through a pipe built into the software of the Network Manager. It is possible to transfer a file or a message directly from one user to another without involving the Winchester disk. Sharenet also offers an optional electronic mail capability.

SHARED ACCESS TO printers, referred to as print spooling, is the fourth major characteristic of the Novell system. Sharenet can support up to five printers simultaneously. The print spooling software assigns document numbers, determines print sequence and manages other job control requirements. Clearly, spreading the cost of expensive peripheral hard copy devices such as character printers and plotters among several users is an advantage gained through networking.

Recently, Novell announced a new network product that uses the IBM Personal Computer XT version as its file server. This product is quite different from Sharenet in that it uses a contention-based bus network protocol instead of a star configuration controlled by the Network Manager.

3Com Corp. of Mountain View, Calif., approaches microcomputer networking from a different perspective. In a star configuration, all communications are routed through and managed by a central hardware controlling device such as the Network Manager. In a bus topology, processing devices are connected to one common transmission medium or cable called the bus. In this situation, messages are typically broadcast by a device in the same way a radio station broadcasts its signal for anyone who might happen to be listening. In a ring topology, messages and files are passed from one workstation or processor address on the network to the next.

There are two widely publicized means for coordinating these decentralized data transmissions. The industry refers to them as access methods. 3Com has designed its system called Ether-series around carrier sense multiple access/collision detection (CSMA/CD). This system is a microcomputer implementation based on Xerox Corp. Ethernet standards.

CSMA means that when a station wants to transmit data, it listens for network activity or messages generated by other devices before beginning a transmission. In other words, it recognizes that there are other users of the network. A collision is detected when there is no message of acknowledgment from a receiving station or when the information is garbled. In this case, all stations wait a random time interval before

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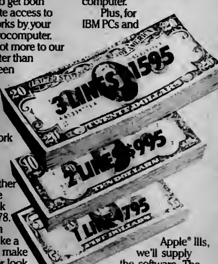

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The logic and programs that direct these transmissions are contained on a network interface card. 3Com now uses Seeq Technology, Inc.'s 8001 data-link controller chip. The 8001 supports all of the minimum CSMA/CD functions and enables 3Com to reduce the size and cost of these cards.

3Com's Etherseries products are compatible with the IBM Personal Computer. In a minimum configuration, every Personal Computer on the network is equipped with an Etherlink expansion card (transceiver). They are then connected by 50-ohm, skinny coaxial cable. In such a configuration, an IBM XT, with its Winchester disk, can act as a file server for other Personal Computers on the network. Specifically, information is transferred by a combination of IBM PC-DOS commands and Ethernet expansion board programs. This implementation also allows a Personal Computer on the network to act as a print server.

In addition, 3Com markets a workstation called the Ethershare Network Server. The package includes a 10M- to 40M-byte hard disk, a 1M-byte floppy disk for backup, 16-bit processor and compatibility with PC-DOS. The Network Server also provides dedicated, rapid access to the mass storage.

3Com's approach to mass storage is to create logical diskettes on the hard disk in 160K-byte and 320K-byte volumes. It is possible for a user to access four diskette volumes at one time. Volumes may be either public or private. Public volumes may be read concurrently, while private volumes may only be used by one person at a time. Each user on the network is assigned a password, and an Ethershare volume may also be assigned a password to ensure the security of the file.

ETHERPRINT IS a software package that can be added to a network server. As with other print spooling packages, the print requests are queued in an Ethershare workstation buffer if the printer is in use. As a result, the microcomputer is free to continue other processing.

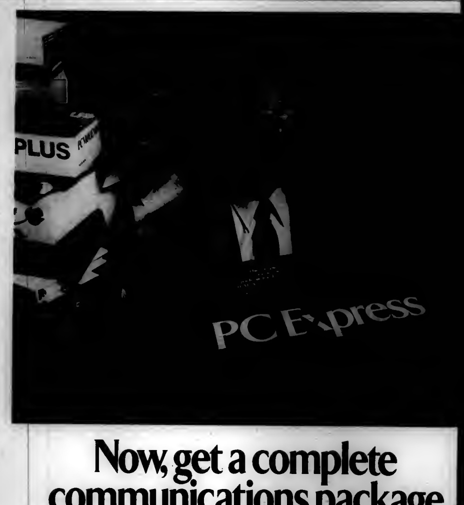
In addition, Ethermail further enhances the network by allowing users to compose, duplicate and distribute any computer-based messages. In addition to marketing a full-function electronic mail package, 3Com also announced a joint project with Xerox and Visicorp last May to support the program Vision on the Etherseries line of products.

Nestar Systems, Inc. of Palo Alto, Calif., uses the second common network access method, token passing, in its Plan 4000 architecture. Each device on a token passing network, regardless of physical location, has a unique address. A token continually moves from one sequential address to the next. A device is permitted network access only when it takes possession of the token. In this way, the token passing network eliminates the contention produced when devices are permitted to transmit simultaneously.

The logic for this access method is also contained on a network interface card. Nestar also utilizes a controller called a Line Isolation Device. This device protects the workstation from electrical impulses on the network and reduces the amount of cable needed between groups of workstations.

Although it is possible to have a minimal working configuration of several microcomputers and one Line Isolation Device, Nestar, like other vendors, offers additional networking hardware and software. Its Plan 4000 File Server provides a wide range of sophisticated features.

The File Server is a console unit with Winchester disks in 60M- and 137M-byte capacities and a high-speed tape backup unit. The File Server software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creates virtual file volumes on the hard disk. Unlike other vendors' products, however, the size of a virtual volume is not necessarily restricted to the size of a real diskette. According to a Nestar spokesman, a virtual volume "can be customized to any size permitted by the user station operating system."

Plan 4000 supports any combination of Apple Computer Inc. Apple II, Apple III and IBM Personal Computers. It is possible to have up to 255 workstations on each network segment, and Nestar provides password protection and file security to control access to shared programs and data.

In the Nestar network, an Apple II or an IBM Personal Computer with a network interface card may function as the network print server. The print server program can support up to six printers of varying types at one station, and multiple print servers may be connected to a single network. The software also displays a simple print menu at each workstation on the network.

Messenger is Nestar's Plan 4000 electronic mail system. Mail can be forwarded, answered and printed. The program also supports return receipt requests and defined distribution lists. Messenger mailboxes may also be password protected.

Omninet is a new network offering from Corvus that uses twisted-pair wire and network interface cards placed directly into the microcomputers. Omninet provides support for up to 64 devices. Unlike Constellation, Omninet does not require a master network control unit.

Instead, Omninet uses a bus network and CSMA method without collision detection. Rather than integrating collision detection into its transmission logic, Omninet simply listens for network activity twice before transmission. This access method, while not as technically sophisticated as a full-standard Ethernet implementation, is complete enough to avoid most collisions. A Corvus spokesman said that "Omninet operates efficiently without collision detection circuitry, which would make the system more complex and expensive."

In the original implementation of Omninet, microcomputers were dedicated to print and file serving tasks (as in 3Com's Etherprint). Early this year, Corvus announced a Z80-based hardware unit that will function as a print server and also announced a gateway that will link Omninet to IBM's mainframe Systems Network Architecture (SNA).

Several microcomputer network vendors now offer this or similar hardware/software links between clusters of micros and large system computing environments. The Omninet-SNA gateway was developed by the Systems Center of San Mateo, Calif.

This gateway software is composed of three elements. At the core of the system is the Network Datamover, which allows for sharing of files and programs between all elements of the extended network. Combined with two other software modules, the Network Access Services and Application Programmatic Interface, the microcomputer can become an intelligent workstation in a large system network. In the coming months, much industry development activity will be focused in the area of file transfer and gateway network access.

Users already have a variety of networking solutions available to them. It is now possible to share the cost of expensive peripherals and gain access to the power of larger systems. The prospective buyer may also choose from a range of sophisticated software capabilities depending on the price of the system. The challenge facing microcomputer network vendors is to integrate the microcomputer more completely into larger computer networks. ■

Caffrey is market research analyst and Willmott is director of user programs at International Data Corp. in Framingham, Mass.

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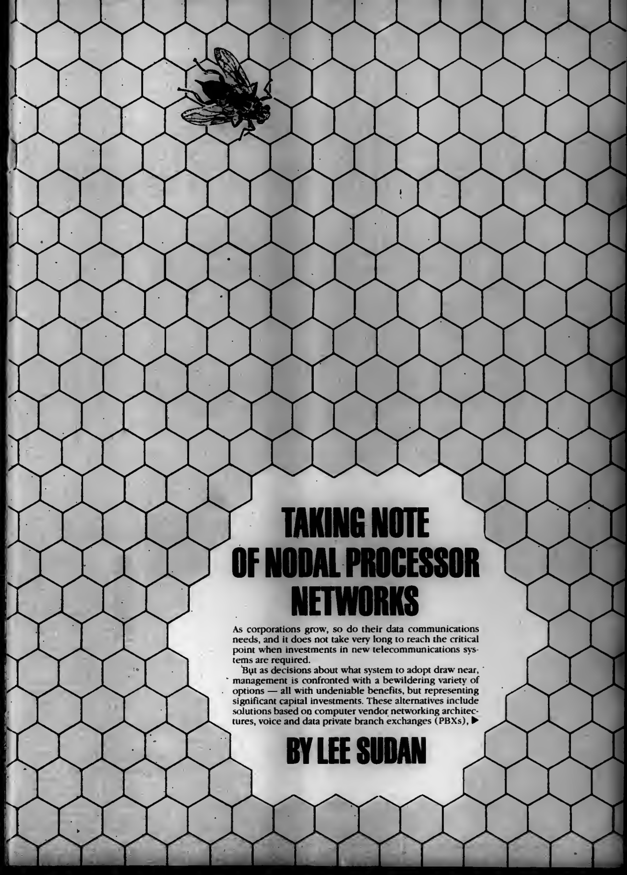


TAKING NOTE OF NODAL PROCESSOR NETWORKS

As corporations grow, so do their data communications needs, and it does not take very long to reach the critical point when investments in new telecommunications systems are required.

But as decisions about what system to adopt draw near, management is confronted with a bewildering variety of options — all with undeniable benefits, but representing significant capital investments. These alternatives include solutions based on computer vendor networking architectures, voice and data private branch exchanges (PBXs), ▶

BY LEE SUDAN

nodal processor networks, public data networks and networks supplied by major carriers.

In the midst of this confusion, however, an important trend is emerging — the concept of the comprehensive nodal processor network. This concept clarifies the role of data communications networks in large corporations and serves as a blueprint for future organizational expansion.

Nodal networks — based on nodal communications processors utilizing statistical multiplexing or packet-switching techniques — may not be suitable for every company. But they are among the several major options being chosen by those laying the groundwork for communications infrastructures to serve for years to come.

Depending on the size of a network, both in geography and number of terminals and hosts, approximately 20% of all data terminals communicate with their host processors from remote locations. With the improving price/performance of mainframes, increasingly cost-effective terminal devices and higher demand for access to centralized data bases, this percentage will continue to increase.

Furthermore, the trend toward multivendor hosts and, in some cases, geographic distribution of processing power will necessitate the consolidation of the network for better operation and performance. While data processing will continue to play a key role, attention will focus on the need for a corporatewide network in which mainframes, minis and various terminal devices serve as integrated components of a monolithic corporate network.

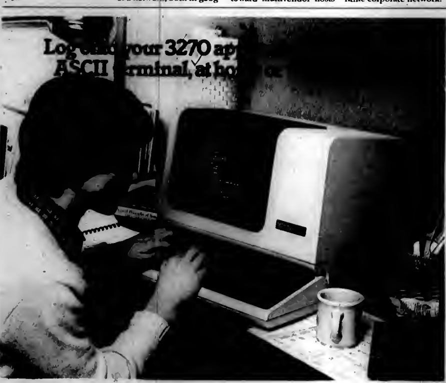
Presently, the cost of data communications is anywhere between 5% and 10% of the total DP budget. This meager expense belies the real impact and importance of communications networks to the future of corporations. A well-planned communications network not only saves communications line costs, but results in higher productivity and better responsiveness to the user community. It also allows the flexibility to add future DP resources based on their merits.

Given all the benefits of data networks, it is not surprising that there are dozens of alternatives available. But before discussing the nodal processor network approach, it is helpful to discuss the most common alternatives.

Most mainframe and minicomputer vendors have started giving in to growing customer demands for increased communications capabilities. The resulting computer networking architectures — for example, IBM's Systems Network Architecture, Digital Equipment Corp.'s Decnet and Honeywell Inc.'s Distributed Systems Architecture — have impressive networking and communications capabilities. Depending on the vendor, they allow multiple host application access, alternate routing, gateways to X.25 and local-area networks, user priority and security access and certain levels of centralized diagnostics and management.

IN ADDITION TO data communications networking, other benefits provided by these architectures include data processing-oriented functions, such as file transfers, program-to-program communications and so on. As a result, the whole network seems like one entity to the user.

Despite all these advantages, the fact remains that these are mostly single-vendor solutions with limited flexibility to add hosts from other vendors and support for diverse communications disciplines. Furthermore, the communications software is host-embedded and requires expensive and time-consuming upgrades to accommodate future network expansion needs. In certain cases, even the addition of a few more users requires significant system



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regeneration and expansion work.

Common carrier-supplied networks fall into two categories: public data networks, such as GTE Telenet, Inc.'s Telenet, Tymnet, Inc.'s Tymnet, Canada's Datapac and France's Transpac; and networks that can be custom-tailored to suit the needs of corporations, such as AT&T Information Systems, Inc.'s AIS/Net 1000, RCA Cylix Communications Network, Inc.'s Cylix and private network solutions from Telenet or Tymnet.

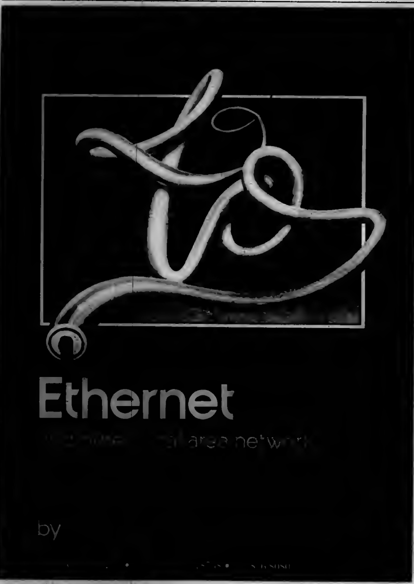
The public data networks that charge on the basis of network use are suitable when data traffic cannot justify private leased lines. These networks also relieve the company of most of the planning, management and operational burdens. Their main limitation is the ability to accommodate communications protocols beyond asynchronous. Sometimes IBM Binary Synchronous Communications (BSC) and High-Level Data Link Control are also supported. However, public data networks can be effectively used to complement a private corporate nodal network.

The second class of networks, especially a custom-tailored subsegment of a large communications network, combines some of the advantages of public data networks with those of private nodal networks. Users benefit from the unburdening of operational, maintenance and administrative work loads, while gaining the advantages of a private network. These networks provide adequate security and personalized control along with support for different communications disciplines. The main factors to consider are the financial trade-offs, the responsiveness of the vendors and the future synergistic alignments between the network's directions and the corporation.

Voice and data PBX-based solutions represent an emerging technology that is still in an embryonic stage as far as data networking and support is concerned. The future of this alternative is promising in certain local networking environments. Currently, it is not clear that an integrated voice and data PBX can adequately optimize both voice and data applications.

There are considerable architectural differences between data nodal processors and the voice PBX to warrant an effective integration of these functions. Data switching lends itself well to the PBX architecture and may further evolve as part of the future PBX. In addition to the functional and technical differences, there may be other pricing, administrative and organizational dynamics that do not favor integration of the voice- and data-oriented functions.

Another alternative is the nodal network — the most advanced stage in an evolutionary process that usually begins with simple, point-to-point communications links between host computers and remote data terminals. With time, the network may expand as locations requiring access to the host computers proliferate. As more lines are needed for additional communications devices, multiplexers combining transmission from multiple terminals over a single line are brought into use.



BUT THERE COMES A time when unplanned growth of such networks leads to inefficiencies. Line costs may increase faster than they should, service costs may escalate as the number of lines increases and overall management of the network may become increasingly costly and difficult. In this situation, the installation of networking nodes at appropriate geographical locations with proper capacity communications links can dramatically reduce costs and increase corporate productivity. A rule of thumb in designing nodal networks, which are cost-effective from the start, is to allow for a quadrupling of network use over time. This would adequately handle an organization's strategic requirements for more than five years. In addition, nodes placed at strategic locations in the network, while cost-effective for the initial applications, should be powerful enough to handle future functions without requiring additions.

Beyond the obvious cost savings, the benefits of a consolidated network are enhanced by other important factors. For example, once a network is in place, additional remote users can be added without having to wait for additional communications facilities and associated equipment. For certain communications environments, the contention and user switching capabilities provided by nodal processors can prevent the need to add new DP resources. More users can contend for a smaller number of computer communications ports, increasing the cost-efficiency and responsiveness to the needs of the user community.

A nodal network also increases the availability of a corporatewide information processing network by reducing downtime due to failures in vulnerable communications lines. Such failures in point-to-point and some multipoint network configurations often lead to loss of service throughout the entire network. Nodal networks allow configurations that automatically bypass failed lines by providing alternate routes for data. As a result, service is maintained to all points. Since this is done automatically, it reduces dependence on personnel to operate and service remote locations in the network.

In addition, nodal networks increase productivity of the corporate information network by improving response times in certain application environments. For example, satellite links play havoc with the response time of BSC-oriented communications environments. Remote polling capabilities of certain packet-switching nodal processors can easily alleviate this problem by eliminating the need for polls to travel through the delay-prone satellite links. A side benefit is the decongestion of the communications links, since typically in such networks, a high percentage of time is consumed by polls.

Another capability of nodal networks — monitoring the network and generating data not only on failure rates but also on usage of lines and terminals — gives management a tool to assess objectively the flow of corporate information. These management reports are easily obtained and analyzed and make it possible to plan not only for rational, cost-effective growth of the network, but also to plan for future growth of the organization.

Packet-switching technology is closely identified with the CCITT X.25 standards. The user data is packetized before transmission. At the destination, it is depacketized and presented to the receiving end. Packet nodal processors readily lend themselves to large networks because of their inherent capability of addressing a large population of user devices. Furthermore, since the packets may travel independently through a network to reach their destination, the network traffic loading is well-balanced. This results in better use of communications lines and minimal delay to users.

PACKET NODES ARE also better suited for remote polling applications in certain BSC communications environments. This affinity results from the fact that these nodes have to intervene with user data to form packets and lend themselves easily to accommodate the polling aspects of the communicating devices. Considering that in most polled environments only 30% to 35% of the total communications is user data (the rest being polls, administrative and control-related), considerable efficiencies can result from remote polling. This process is even more useful when satellite links, which introduce heavy delays in polled applications, are involved.

A further attraction of packet switching is its standardization around the international X.25 protocol. As more vendors offer products conforming to this standard, the options for applications and new packet-switching network configurations will continue to increase. Additionally, widespread acceptance of the X.25 standard by DP communications vendors will ensure that networks conforming to it will not be compromised if the initial designated vendor fails to live up to expectations. It should be noted that X.25 is an interface standard and does not provide for communications between incompatible machines.

A disadvantage is that CCITT standards only exist for asynchronous communications. There are, however, some standards for handling BSC data that have been agreed upon by a few public data networks. Packet switching is also limited by its inflexibility and costly accommodation of different communications disciplines due to its nontransparent nature. In this case, the nodal processors based on statistical multiplexing are much better suited.

Because of their intelligence and processing power, nodal processors based on statistical multiplexing techniques provide the optimal combination and range of applications, flexibility, expandability and response to top management's needs. For example, because of their transparent handling of a terminal's data stream, they are extremely flexible when it is necessary to accommodate new protocols used by different vendors' terminals and host computers added into the network mix.

This introduces minimal delay in the system and usually does not require any modifications to the existing system. Therefore, a nodal network based on statistical multiplexers is extremely flexible, with additional applications, expansion and changes in network topologies achieved at minimal cost.

The more sophisticated statistical multiplexing-based nodal processors, such as Codex Corp. 6050 distributed communications processors, have capabilities that approach those of the packet nodes. For example, the adaptive routing, network load leveling and

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* 3Com Corp. at March Systems & Software pg 118
** 3Com Corp. at March Systems $ Software, pg 119

management and control capability and handling of hand-speed user data stream are functions similar to the packet nodes.

In addition, it is highly conceivable that the statistical nodal processors accommodate packet switching via X.25 gateways, built-in X.25 packet assembly/disassembly devices or other capabilities unique to packet requirements. This hybrid capability results in the ultimate solution that combines the benefits of both technologies.

The disadvantages of statistical multiplexing are only apparent when large networks are designed in which several nodes can be arranged in tandem. In this case, the internodal frames are demultiplexed at each intermediary node, resulting in delays that sometimes become excessive. Remote polling techniques, however, can alleviate these problems

No matter what option a large organization chooses for its network — whether a vendor-based mainframe or minicomputer communications architecture, a packet-switching scheme or a nodal processor network based on statistical multiplexers — there is a common set of issues to consider before starting. Handling these issues ahead of time can reduce oversights that might hurt the organization and management information structure later on.

One major consideration is the chosen vendor's ability to keep up with an organization's future needs. These needs include the ability to expand the network along with the management and information structure of the organization. They also include the ability to aid in planning, designing and installing the most efficient and cost-effective network possible while meeting the organization's strategic and logistical requirements. In addition, a vendor should be able to support and service the network on an ongoing basis once it is installed.

Another important issue is adaptability of a vendor's machine architecture to meet future user requirements, from both the hardware and software point of view. First, there is the obvious need for hardware modularity so that enhancements can be added in a cost-efficient way as the network expands. The software structure should also be studied so that modifications needed to interface with other systems do not result in an overhaul of other software elements of the system.

A recent technological trend — toward management and control of the network through sophisticated diagnostic capabilities and cost-effective backup schemes — is important to management. Because the costs of labor-intensive tasks such as maintenance and service are escalating while the cost of computer-based diagnostic services are leveling off or even decreasing, they will be key in bringing control of networks more into the hands of management.

IN THE FUTURE, there will be a continuing trend toward integrating further functions and techniques in nodal processors. They will support different communications disciplines from computer and communications vendors, continue supporting new and faster data terminals, provide access to local-area networks, carry digitized voice and continue developing their ability to monitor and manage the flow of information through the network as the organization grows.

This management and control over growth and development of corporate information networks provided by nodal communications processors is bound to continue increasing in importance as data communications networks become more integral to the successful growth and daily functioning of corporations. ■

Sudan is director, network products, Codex Corp., Mansfield, Mass.

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THE *myths* BEHIND VOICE/DATA INTEGRATION

"Integrated voice and data communications is a requirement for modern office systems." "All-digital private branch exchanges [PBXs] will provide a single integrated networking solution." "Advanced services telephone networks will provide voice and data integration along with protocol conversion and similar capabilities allowing dissimilar equipment to communicate effectively."

Statements like these are often encountered in lectures by industry experts, trade press articles and pronouncements from communications equipment and services vendors. Under these circumstances, it is not surprising that so many users are tempted to think that the integration of voice and data communications is absolutely desirable.

Moreover, it is a fundamental human characteristic to seek ▶

BY WILLIAM F. ZACHMANN

ILLUSTRATION BY KRISTIE VANVALKENBURGH

> ***In addition, it is necessary to encourage users to be wary of automatic, gee-whiz, technology-based panaceas and apply the same rational skills to technology-related decisions that are generally used in other business areas.***

simple solutions to complex problems. We seem to have an innate tendency to want to believe anyone who offers some sort of panacea, some unified solution.

The consequence of this is that certain questions typically do not get asked, questions such as: What is the real value of voice and data integration to our organization? How much will it really cost, compared with the alternatives? What will it contribute to our business objectives? Do we give up anything if we insist on integrating voice and data communications? Can a single integrated network really meet all our needs at a reasonable cost?

This is not to suggest that there is anything wrong with integrating voice and data communications. Experience with a number of user situations, however, has shown that it is by no means to be taken for granted that voice and data integration, as an end in itself, serves the rational business aims of an organization. No technology pursued as an end in itself does that.

In addition, it has become clear that many basic misconceptions about voice and data integration have been spread by various sources: its definition, implementation procedure, value and cost. These misconceptions do not serve users well. It is necessary to identify some of these misconceptions, provide factual information as an antidote and establish some reasonable criteria to help users decide what voice and data integration can or cannot do for their organization.

In addition, it is necessary to encourage users to be wary of automatic, gee-whiz, technology-based panaceas and apply the same rational skills to technology-related decisions that are generally used in other business areas.

The definition of voice and data integration is not as self-evident as it may appear at first glance. This is more readily apparent if we reverse the question and ask, "What *isn't* it?" Typically, we are tempted to say that it is not the traditional method of voice and data communications. The newer technologies, contrasted with those of the past, are said to offer integrated communications.

But is the old way really so unintegrated? After all, the telephone system has always been used for voice communications. This includes both the telephone company network and the on-premise PBXs supplied by the telephone company and independent vendors. In addition, that same telephone system has typically been used for data communications, except for locally wired direct connections to a computer.

In the past, the telephone system has been used for CPU-to-CPU communications between sites, remote job entry station-to-CPU, dedicated lines for concentrated terminal communications, dedicated or dial-up lines for remote sites and nearly all other remote data communications. And many organizations have provided

dial-up or dedicated access to time-sharing systems in-house via the telephone system.

Integrated means to form or blend into a whole, to unite. Thus, use of the same telephone system for both voice and data communications — as has been done all along — certainly deserves to be called integrated. Yet it is precisely this same system that is contrasted with supposed integrated voice and data networks of the future.

Like the characters in the Hans Christian Andersen fairy tale, "The Emperor's New Clothes," we are likely to defer to the expert opinion and concede that our own vision is faulty. In the process, a hidden assumption is overlooked.

A communications expert might object to our calling the telephone system integrated because it is not all-digital. He might say, "Voice transmission is analog, and you must use modems for data transmission over voice lines. How can they be called integrated?"

Like the characters in the Hans Christian Andersen fairy tale, "The Emperor's New Clothes," we are likely to defer to the expert opinion and concede that our own vision is faulty. In the process, however, a hidden assumption is overlooked. The communications expert implies that integrated must implicitly mean "integrated all-digital." By this definition, the old-fashioned telephone system is not integrated, simply because it is not all-digital.

This is more than just silly word play. It also involves a bit of public relations. Many vendors are eager to sell users on new, relatively expensive equipment designed to replace older telephone systems. That new equipment is or will be digital and will replace analog systems.

These vendors want the user to buy their equipment, so they tell him his current system is not integrated. This teases the user into believing there is something lacking in his current system, motivating him to do something about it. This strategy is more effective than simply telling the user his current network is not all-digital.

Equating integrated with all-digital not only violates the English language, it also has two secondary effects. First, it conveys the sense that there is something wrong with the current system. Second, by association, it implies that if the user's system is not all-digital, it is not integrated.

Digital has gradually acquired positive value connotations from other sources as well. Given that when most people refer to integrated voice and data communications they mean all-digital, the questions listed earlier concerning the benefits of integrated networks can be recast and applied to integrated digital networks. The new feature is not the integrated, but the digital.

The old-fashioned telephone system was originally a strictly analog system. The electrical voltage patterns on the telephone lines that carried voice signals were analog signals that fluctuated continuously in the same way the air pressure fluctuates when someone talks. The frequency and amplitude of electrical signals on a telephone wire correspond

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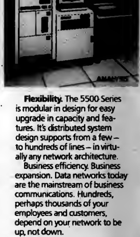

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Taking all of this into consideration, isn't it clear that we are steadily moving toward an integrated all-digital voice and data network that will soon meet all our communications needs? Why all this carping then? What is wrong with this picture?

with the fluctuations in frequency and amplitude in sound pressure as an individual talks into the telephone. The bandwidth of the telephone system — about 3,000 cycle/sec — was originally designed to handle the speaking range of the human voice.

Data is primarily represented in binary digital form. For data communications, therefore, a method of representing two voltage values — and for certain purposes a third implying no data — on a wire. Transmission of data on a telephone line requires some way of changing the pattern of one-voltage and zero-voltage of a digital representation into some form of signal within the bandwidth limitations of the telephone system.

This is generally done either with an acoustic coupler or a direct-connect modem. An acoustic coupler makes the pattern of ones and zeros into different tones that go into an ordinary telephone mouthpiece. It then reads them out of the earpiece. A direct-connect modem bypasses the telephone handset and generates and detects an electrical signal representing the data directly on the telephone wire connections.

Because the ordinary telephone system provides only a 3-KHz bandwidth, there are fundamental limitations to how fast data can be handled on a standard telephone line. Modems have to be complex in order to provide data rates approaching the theoretical limits of a 3-KHz channel. Rates of 9,600 bit/sec or more require fairly complex, hence expensive, modems. It seems unlikely that there will be much more than 19.2K bit/sec transmission over old voice lines.

Maintaining physical metal-to-metal connections for an analog telephone circuit over long distances requires many pairs of wires to handle telephone traffic. For some time, the telephone system has been converting analog voice signals to digital form to permit multiplexing multiple telephone conversations on a single coaxial cable. This is gradually replacing older analog multiplexing using frequency division. Fiber-optic cable provides an excellent long-range transmission medium for multiplexed digitized voice conversations.

The voice signal on a 3-KHz channel, when digitized, requires a data rate of 64K bit/sec if it is not compressed. That is obviously more than the 19.2K bit/sec maximum data rate attainable over an ordinary voice line. So if digitization of the voice signal is extended to the subscriber premise, outgoing and incoming, then obviously there will also be a digital data rate capability (at 64K bit/sec) accompanying it that is greater than the best that can be provided over analog lines (just under 19.2K bit/sec).

All-digital PBXs logically complete the picture of the ultimate all-digital external telephone network. Given that they will handle digitized voice at data rates higher than those currently available over voice lines, they also can

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Taking all of this into consideration, isn't it clear that we are steadily moving toward an integrated all-digital voice and data network that will soon meet all our communications needs? Why all this carping then? What is wrong with this picture?

THERE ARE TWO things wrong with it. First, the integrated all-digital network has not arrived and will not be here soon enough to meet users' near-term needs. In addition, it will be expensive enough to make less glamorous alternatives competitive and sometimes clearly superior for some time to come.

Second, an entire range of new technologies is emerging both on-premise in local-area networks and externally in metropolitan area bypass techniques and long-distance alternatives. These will create a competitive environment that may slow the development of the external all-digital network because of lack of capital. In addition, they may create internal requirements for data communications that the digital PBX will be hard-pressed to match at competitive prices.

On-premise requirements for emerging distributed resources systems will greatly alter the appetite for bandwidth. Although transmission speeds in the 56K or 64K bit/sec range that have been promised (but not really delivered yet) by digital PBX systems offer more than those currently available on most premises, local-area network systems capable of handling high-speed bursty traffic at megabit speeds are already within view. Higher speeds for many devices simultaneously are both difficult and expensive to provide within PBX architectures.

If present telephone-line data transmission speeds were all the future required, success of voice and data digital integration would be certain. But local-area networks will provide even higher speeds more economically over the next five to 10 years, opening up system design opportunities that users will not want to ignore.

Meanwhile, capital requirements to complete an all-digital telephone network in the U.S., given the divestiture of the Bell operating companies, will be difficult to meet. Competitive pressure from bypass technologies and the regulatory attempts to keep local telephone rates down will provide major challenges in obtaining that capital. All this will delay, rather than accelerate, the implementation of the all-digital integrated services digital network.

There is nothing fundamentally wrong with the idea of an integrated digital voice and data network. It is undoubtedly the way of the future. But this does not necessarily imply that it is beneficial to try to have one now or that users should wait for it to arrive before trying to improve their network.

Integration of voice and data is probably desirable to some degree. But the solution to the particular problems that must be dealt with over the next three to five years will not automatically entail voice and data integration. In particular, many organizations will find that they will require both a digital PBX and a local-area network for on-premise communications. And solutions to metropolitan and long-distance networking requirements are almost certain to require mixed solutions for some time to come. ■

Zachmann is vice-president, corporate research, at International Data Corp. in Framingham, Mass.

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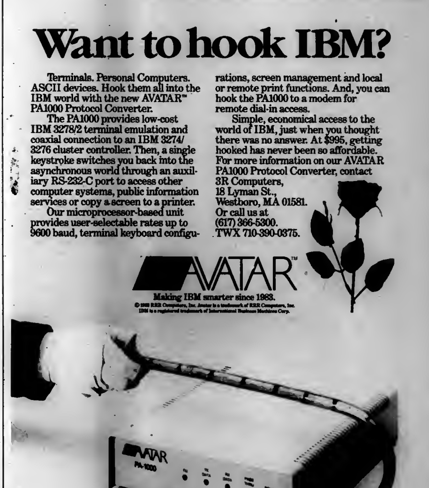

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CROSSING THE LINES WITH VOICE MAIL

BY EMIL WANG

From relative obscurity as recently as three years ago, voice messaging or voice store-and-forward has become increasingly prominent as the next growth segment in the office automation market. Why has there been such interest in voice messaging, and why should managers of data processing, management information systems, office automation or telecommunications be aware of developments in this field? The answer lies in the functions and capabilities of voice messaging that open new areas of productivity at a low cost.

People often wonder if voice messaging is just a fancy telephone answering machine. It is; to the extent that word processing is just a fancy typewriter. However, voice messaging systems promise to entrench themselves in the office because they reduce telephone tag, extend the work ▶

place and the workday, improve communications, reduce paperwork and focus on a neglected segment of the office.

Voice store-and-forward is the capability to digitize voice, compress it and store it on hard disk for later retrieval. Voice has been digitized for some time in private branch exchange (PBX) systems. In a typical telephone conversation, voice is commonly digitized for switching purposes and long-distance transmission. In voice store-and-forward, this digitized voice must be compressed to a manageable amount of data. The improved cost-effectiveness of voice messaging has been a combination of the increased efficiency of compression algorithms and the decreased cost of data storage.

Once digitized and stored, a voice message can be managed like any other data. It is similar to electronic mail, except that the input medium is voice rather than a keyboard and the terminal is a push-button telephone rather than a CRT terminal. In a voice messaging system, the commands are dual, multifrequency tones from a push-button telephone, as opposed to Ascii characters.

Voice messages can be sent to one person or several simultaneously. Users retrieve messages at their convenience, send responses and forward them, if necessary, with a comment to another user. The list of capabilities is extensive.

THE REASON that is most often cited for the growth of voice messaging systems is the elimination of telephone tag. Studies indicate that up to 75% of all business calls do not reach the intended party on the first try. The result is a pink message slip that is not really a message, but a notation that one person is trying to reach another.

Another hindrance to telephone communications is the inability to transmit information when the caller is ready, rather than when the called party is prepared to listen. Business is routinely conducted on a global basis with employees separated by time zone or frequent travel. In today's constantly expanding work place, it is important to have the capability to transmit information at any time from any push-button telephone.

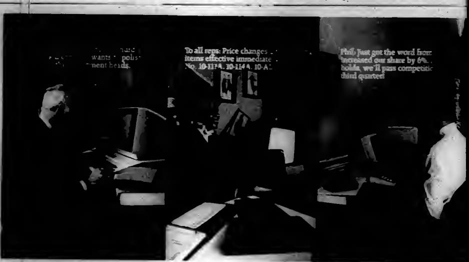
Voice store-and-foward provides cost savings in the production time needed by a secretary to type memos on such topics as meeting times, scheduled events and office policy. Information can be relayed easily and faster by using voice messaging.

A secretary can route detailed messages to a distribution list and receive confirmations from the system that the messages have been received. The voice memo takes little time and effort and can be delivered immediately without being delayed in production, review and mail delivery. News that might otherwise be forgotten can be transmitted with the emotional tone of the speaker's voice intact.

Until now, white-collar workers have been a neglected segment of the automated office. Productivity enhancements offered by office automation have been extended first to clerical and computational workers, with little capital investment available for white-collar workers. However, it is within the latter group that productivity must be increased, since these workers are not paid an hourly wage, and it is unlikely that reduction in manpower is intended.

The problem has been finding a productivity tool that is measurable for these workers. Voice messaging is one solution because white-collar workers are communications-intensive. Voice messaging is a viable capital investment for the manager who has been handed a mandate to improve department productivity.

How have vendors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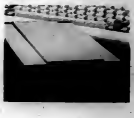

they operate with rotary dial, Touch-Tone®* and key-set systems. At full or half duplex. And both Smartmodems feature self-test capabilities.

Hayes Smartmodems are available at two different speeds and price levels. The lower-priced Smartmodem 300 is ideal for local data swaps and communicates at 300 bps. For longer distance and higher volumes, Smartmodem 1200 transmits at 1200 bps or up to 300 bps, with a built-in speed selector that automatically detects transmission speeds.

We've also included indicator lights that let users see what their Smartmodem is doing, while an audio speaker lets them hear it. (Is the remote system down, or was the line just busy? This way, they'll know.)

Hayes has prepared a directory of the many communications pro-

moved to fill this need? Voice messaging has its roots in the radio paging industry. Companies such as Commterm, Inc. and Sudbury Systems began as radio paging services that allowed subscribers to retrieve voice messages. These companies adapted their equipment to serve the voice store-and-forward market as well. In the late '70s and early '80s, the companies were supplemented by start-up firms, such as VMX (formerly ECS Communications), and such well-known vendors as Wang Laboratories, Inc. and IBM. These vendors made the market credible and refined the product offering.

The initial reception to voice store-and-forward products was enthusiastic. Nevertheless, the market developed more slowly than many people had hoped. One reason was cost: As with any emerging market, the initial product offerings were high-priced. For example, both VMX and Wang have either introduced lower priced lines, or they have reduced their price in hopes of stimulating the market.

The initial voice messaging systems are known as stand-alone systems. All the voice store-and-forward features are available to the subscriber in these systems. A nonuser, however, has limited system access or none at all. Therefore, messages originate only from other users. This may be acceptable for applications in which internal employees communicate primarily among themselves. However, since most businesses communicate with people outside an organization, a stand-alone system requires users to rely on message slips.

An alternative to a stand-alone voice messaging system is a system integrated with a PBX, such as the Rnlm Corp. Phonemail system The processor that controls the voice messaging system communicates with the PBX processor through a software control link that is proprietary to the PBX manufacturer. This control link, in addition to allowing all the standard voice store-and-forward features, expands the voice messaging capabilities in two significant ways.

ONE BENEFIT of PBX integratinn concerns telephone answering that is automated. A caller may try to reach you, but you are away from your desk or on the telephone. Instead of forwarding the call to a secretary, the PBX forwards it to the voice messaging system. The system needs to know the extension of the call's destination, which is provided by the PBX processor through the control link. In stand-alone systems, that information must be provided by an outside party.

The caller automatically hears a system greeting or a personal greeting, prompting the caller to leave a message at the tone. In a truly integrated system, the call may also be returned to the company operator. After the caller leaves a message, it remains in the voice mailbox. Rather than simply creating another locale in which to place messages, an integrated system can consolidate them. The messages can be accessed whenever it is convenient, and the user hears all messages in the caller's voice.

The second major area of improvement in integrated systems is in message notification. In most PBXs, there is a message notification light available with the telephone. In an integrated system, the PBX switches the light on as an alert to check for new messages. The light is reinforced by a broken dial tone that indicates messages.

These features have proven key in actual implementation. Without them, the user would be forced to call in periodically to check for messages. With message notification, a user only calls when there is information. Moreover, in an integrated

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Smartmodem Specifications
Low Speed Data Format: (Smartmodem 1200 and Smartmodem 300) Serial, binary, asynchronous 7 or 8 data bits, 1- or 2-stop bits, odd, even or no parity.
High Speed Data Format: (Smartmodem 1200) Serial, binary, asynchronous, 7 data bits with even, odd, or fixed parity or 8 data bits and no parity.
Dialing Capability: Touch-Tone and rotary-dial pulse dialing.
Commands: (unnecessary with Smartcom II software) A Immediate answer. A/ Repeat last command. C Transmitter Carrier. D Dial command, including simple dialing, waiting for second dial tone, auto-dialing and other features. E Local echo. F Full/half duplex. H Switch hook. M Audio monitor. O On-Line. P Pulse dialing. Q Quiet mode. R Reverse originate/answer. S: 17 "Set" commands allow user to select various operational parameters, such as dialing speed, escape code character, number of rings to answer on, etc. S? Checks operational parameters above. T Touch-Tone dialing. V Verbose result codes.
Result Codes (can be numerical/verbose): 0/OK Command line ok. 1/Connect Carrier detected. 2/Ring Phone is ringing. 3/No Carrier Carrier lost or never heard. 4/Error Error in command line. 5/Connect 1200 Carrier detected at 1200 bps. (For Smartmodem 1200 only.)
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Interface: RS-232C.
Intelligence: Z8† microprocessor with 4K byte control program for Smartmodem 1200. Z8 microprocessor with 2K byte control program for Smartmodem 300.
Modem Capability: Bell System 103 or 212A compatible originate or answer mode for Smartmodem 1200. Bell System 103 compatible originate or answer mode for Smartmodem 300.
Receive Sensitivity: -50dBm for Smartmodem 1200; -45dBm for Smartmodem 300.
Transmit Level: -10dBm.
Registration: FCC Registered for direct-connect to the nationwide phone system. Connects with modular jacks RJ11W, RJ11C, RJ12W, RJ12C, RJ13W, RJ13C. **Power Pack:** U.L. listed 120VAC 60Hz 13.5VAC output.
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system equipped with telephone answering, the messages are brief business messages for which there would otherwise be a written note. Thus, there is no need to create sample messages to encourage use. A caller must access the system to conduct normal business, so use of the system is learned quickly.

There are other benefits to integration, including interaction with other PBX features. Examples of such features are the ability to identify calling party extensions and to camp on to a busy telephone rather than leaving a message.

Most of the cost-justification arguments for voice messaging have centered on reducing telephone costs. This savings stems from fewer wasted calls and calling during lower toll cost periods. However, it is important to note that the true justification for voice messaging lies in productivity improvements rather than hard-dollar savings. For example, some users' telephone costs may actually increase.

The automated telephone answering system produced by integrating a voice messaging system with a PBX gives the potential customer a new source of cost justification. This concerns the cost of answering telephones within an organization. Assuming that a company does not want its unanswered calls to keep ringing, there are three possible ways that calls can be answered: Secretaries can answer them, a dedicated message center can be used or an integrated voice messaging system can be used for situations in which a personal response is not critical.

Secretaries have represented the traditional way to answer telephones. In some cases, they spend 30% to 50% of their time this way. Using some reasonable assumptions, a company may spend $100/person every month to have the telephone answered by a secretary.

Dedicated message centers may be able to cut that cost in half. Such message centers have been used to a greater extent for employees who do not require a personal secretary. This is a cost-effective way to reduce telephone answering costs. Depending on the assumptions regarding the number of people that can be supported by a single message center, the monthly cost may range from $33 to $67/person.

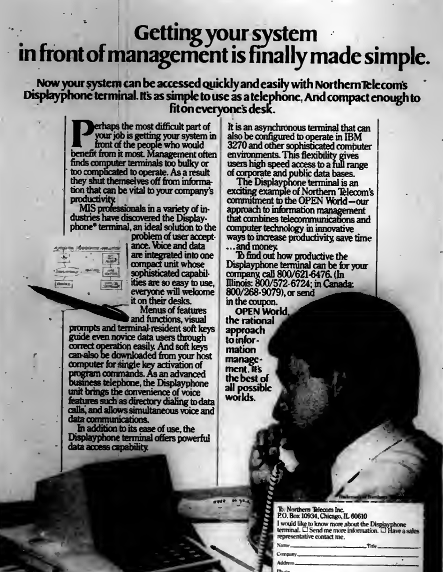
An integrated voice messaging system offers yet a third alternative. A minimal integrated system can offer telephone answering services for approximately 100 people at a cost equal to or below that of a dedicated message center. Moreover, since a voice messaging system can be easily expanded, there are economies of scale.

When more people are supported, the monthly cost can drop to below $10/person. In contrast, the cost for a secretary's support or message center would not decrease as the number of people supported increased, since there is a limit to the number of people each alternative can support.

Viewed in this light, an integrated voice messaging system is a logical way to reduce telephone answering costs. In addition, such a system also provides the added benefits of voice store-and-forward.

The telephone was a marvelous invention for two-way simultaneous conversation. In modern business, however, such conversations are increasingly difficult and often unnecessary. Voice messaging allows for nonsimultaneous one-way information flow. Integrating voice messaging with PBXs has enhanced those capabilities and has extended the appeal of voice messaging systems to a broader category of user. At the same time, it has allowed for a more logical approach to cost justification. It is reasonable to assume that more integrated systems will be introduced and that the fulfillment of the voice messaging promise will be reached. ■

Wang is group product manager, office systems, Rolm Corp., Santa Clara, Calif.



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CONCENTRATING ON THE FUTURE

BATAVIA, Ill. — One of the world's most advanced scientific research centers is no longer being thwarted by outdated communications technology. The Fermi National Accelerator Laboratory (Fermilab) here is using data concentrators to enhance the rural, dial-up, four-wire telephone lines that link it to an inquisitive outside world.

As part of its efforts to probe the basic structure of matter — the infinitesimal particles that are the brick and mortar of subatomic structures — Fermilab operates the largest particle accelerator in the U.S., a four-mile circular tunnel lined with 2,000 powerful electromagnets. And the accelerator is augmented by booster accelerators, laboratories and support facilities on a 6,800-acre site in Batavia.

In 1980, experimenters from Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Va., were collaborating on multiparticle spectrometer experiments at the Fermilab Meson Laboratory. "It was crucial for our research team to be able to access the computer resources at Fermilab," John Ficenec, a professor of physics at Virginia Tech, said. "The option of commuting to Fermilab on weekends was not acceptable. Research team members have to balance their teaching responsibilities and research output, and the attendent costs and stops and starts of commuting would have been sheer drudgery."

Thus, it became necessary to emulate the lab's on-site use of computer resources at Virginia Tech. It was necessary to find an economical way to transmit data error-free between Batavia and ▶

Blacksburg and to develop a remote workstation with the sophisticated graphics and other capabilities of the workstations at Fermilab.

A strong reason for developing a communications link with Batavia was that Fermilab houses powerful computing facilities and extensive data files that are dedicated specifically to the investigations at hand. Included are three interconnected 256K-word (a six-bit byte) Control Data Corp. Cyber 175 processors that share 500K words of extended core storage, 12G bytes of disk and 29 magnetic tape drives. The Cybers communicate with the outside world through two CDC 2551 network processor units. In addition, an IBM 4331 and five Digital Equipment Corp. VAX-11/780s supplement this power.

Specific experiments and development projects are assigned their own data acquisition computers. Typically, these are DEC PDP-11/45s with 124K bytes of memory, 5M-byte disks and other peripherals as required.

The computers in the central computer facility, along with many of the data acquisition systems, more than 400 on-site terminals or workstations and equipment at several remote locations, are interconnected through a Micro Systems, Inc. Micro600 Data private branch exchange (PBX). This allows any of the terminals or computers to access any device in the network under centralized control.

Obviously, it was not feasible for Virginia Tech or any other outside facility to replicate this enormous set of computing resources. Thus, researchers from other institutions were prompted to investigate data communications alternatives for accessing the facilities at Fermilab.

In the fall of 1980, dial-up access through acoustically coupled voice-grade telephone lines was established experimentally between Blacksburg and Batavia. However, the essentially rural location of both Fermilab and Virginia Tech was a problem: Telephone systems that were intended for outlying subscribers did not meet the service and line-quality requirements of high-speed data communications. "The local telephone lines are not good," Ficenec said. "In addition to being prohibitively expensive, the rural dial-up lines consistently produced error rates that made the link useless."

But at that time, Fermilab was developing on-site terminal clusters, which were linked to its central computer facility through error-correcting data concentrators, Micom Micro800s. Since the concentrators are suitable for long-distance use and provide reduced telephone costs as well as automatic retransmission when an error occurs, Virginia Tech began experimenting with them.

The concentrators were tested at either end of a leased line between Virginia Tech and Fermilab. They are capable of delivering error-free data from up to 16 terminals over a single rural telephone line. The concentrators solved the problem with the local telephone company, easing communications for the researchers at Virginia Tech. "If it were not for our absolutely gorgeous Micom concentrators, we would be dead in the water," Ficenec said. "They allow us to get around the local telephone lines."

With the communications problems solved by the concentrators, it became possible to replicate the on-site terminal clusters at Virginia Tech and other sites. At Virginia Tech, for example, eight channels operate through a leased four-wire, voice-grade telephone line with Racal-Milgo, Inc. 5500/96 modems and Micom concentrators at each end. The channels are assigned to several applications:

- Three channels operate at 1,200 bit/sec and are used for graphics. Two of the graphics terminals are Lear Siegler, Inc. ADM-3s equipped with additional units, such as a Digital Engineering, Inc. Retro-Graphics RG-512 graphics

Obviously, it was not feasible for Virginia Tech or any other outside facility to replicate this enormous set of computing resources. Thus, researchers from other institutions were prompted to investigate data communications alternatives for accessing the facilities at Fermilab.

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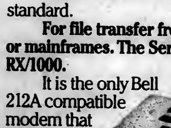

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board and a compatible Graphx-Cursor X-12 interactive joystick. The other graphics terminal is a Color Graphics Envision 230 that provides a 640-by-400 resolution color display.

Each graphics terminal has a switch-selected connection to a DEC LA-120 printer enhanced with a Textprint Declor modification that produces black-and-white or color graphics, as well as conventional text. And the Number 1 graphics terminal can be switch-connected to a Racal-Vadic, Inc. 3455 modem that provides network-independent, dial-up access to non-Fermilab computer systems.

- Two channels, one operating at 2,400 bit/sec and the other at 300 bit/sec, are assigned to a second LA-120 printer and to a Diablo Systems, Inc. 630 printer, respectively. The former is used for high-speed output of long communications, while the latter takes care of quality short-run printing.
- Two channels run Lear Siegler ADM-3A-Plus terminals at 1,200 bit/sec for program development, interactive debugging and text editing.
- The eighth channel, with a Racal-Vadic VA-103 answer-only modem that runs at 300 bit/sec, provides remote dial-in access to Fermilab via the Micro800 link.

Once the communications problem was solved, this workstation at Virginia Tech provided service just as though it were on-site at Fermilab.

"With the concentrators, we can conduct data analysis right here at Virginia Tech," Ficenec said. "If you take a model of every team member commuting to Fermilab once a week, the cost savings is as much as $50,000 a year. And now our researchers do not have to put up with the personal misery of commuting or the inadequacies of the local telephone lines."

Today, after nearly three years of experience with the link, the same four-wire, voice-grade line continues to connect Virginia Tech and Fermilab. The Micro800 now has an optional satellite compatibility feature that allows for nonterrestrial communications, should it ever become necessary to find an alternative to the telephone system.

Since the data concentrators quickly paid for themselves and the other communications devices through savings on line charges, the only recurring communications cost is the regular telephone bill, currently running at approximately $10,000 a year and increasing at a rate of about 25% annually. Implicit in this is a savings at the present level of use of nearly $20,000 a year in line charges, not to mention the additional cost of reruns that would be necessary to clear errors introduced by the telephone lines.

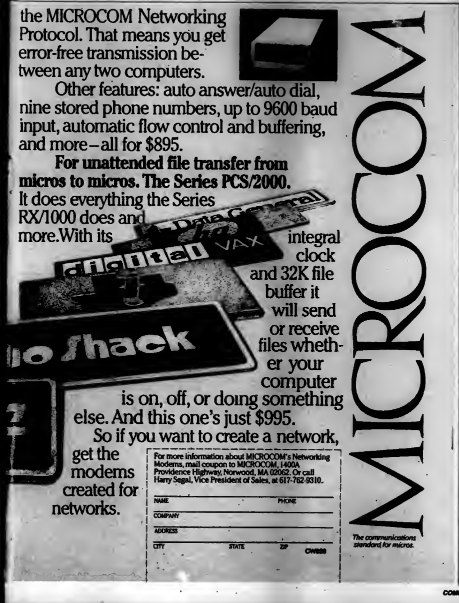
SIX UNIVERSITIES have added their own Micro800-based communications links to Fermilab based on this experience, and new users are hooking up at a rate of about three per year. Savings on links alone surpass $50,000 annually. Experimenters at Michigan State University had the same problems experienced at Virgina Tech. Maris Abolins, professor of physics at Michigan State and head of an experimentation team, explained, "Today, many experiments are collaborative, and the experimenters, who are often located at several universities, need access to a common data base and a central point for sharing information. With cost and time considerations putting repeated trips to Fermilab out of the question, the only alternative is data communications."

Michigan State set up the same system as Virginia Tech and is now realizing substantial savings. "Now that our equipment is paid for," Abolins explained, "our only costs are equipment maintenance and $518 /mo. for our leased line to Fermilab. But when we used dial-up access for a short time at the outset, our telephone bill was thousands of dollars a month because we have three or four students, postgraduates and faculty members using the workstation all the time throughout the day."

Access to Fermilab's computer resources is not the only benefit realized by providing remote users with a data communications link to the facility. For example, since the data concentrators at Fermilab are connected to the central Micro600 Data PBX, it is easy for remote users to connect with each other to share files.

In addition to linking universities to Fermilab, the concentrators also ply their line-sharing/error-correcting capability in support of computing at the lab itself. Depending on the distances involved, they are connected to their respective communications lines either through regular modems or line-driver modem substitutes. The concentrators are also available with integral modems, but few of Fermilab's units are of that type.

The concentrators and the error-free communications they provide are now taken for granted: Few users even know that they are part of the system. ■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EXIT

Rick Le Page of CW Communications, Inc., Framingham, Mass., submitted this anecdote about an electronic editorial system.

We called him PDQ in honor of the company he supposedly worked for. When I walked into the classroom on the first day of a two-week course in the use of Atex, Inc. electronic editorial systems, he proceeded to tell me all about himself: where he went to college, where he worked, how he was quickly moving up the ladder past those "old fogies," how he would be making "lots of bucks real soon" and how much he knew about the computer system. It looked like it was going to be a fun two weeks.

PDQ's firm, a magazine publishing house, had installed their system three weeks before the course began. To hear him talk about the "wonder system," one would think he had slept with it every night during those three weeks. Our system had been in place for about two years, and I was already quite familiar with it.

PDQ started to bother the class and the instructor very early on. He would answer a question intended for the teacher — usually giving the wrong answer and confusing the questioner even more. So I used one of the system's nicer features, the broadcast function, and sent a message to the echo field at the top corner of PDQ's screen. The message was simple: "System coming down rapidly — please log off."

PDQ logged off. The teacher asked him if he had a problem, and he replied smugly, "No, just waiting for the system to come back up." The instructor said the system was fine, so PDQ logged back on, mumbling something about the system being "wacky."

Another student joined me in the effort to give PDQ his comeuppance, and we broadcast every system-related phrase we knew, including, though probably going too far, "Ouch! Careful with the keys."

For the coup de grace, we rigged up his logon file so that every time he logged on, the message "Request aborted" would flash on the screen. Then, a file we had created would flash a completely blank field in bright green, then dull green and then the system would log him off.

The teacher walked in on the first flash and started laughing just as PDQ swore that the system blew up on him. PDQ logged on again, and the same thing happened. Finally, he turned around in a blue funk.

The teacher gave him a new logon to pacify him and gave us a glance that told us to cool it. The rest of the week was very quiet — I don't think the poor guy responded to any system requests for the rest of the course.

Please submit anecdotes along with a picture to Editor, Computerworld On Communications, *375 Cochituate Road, P.O. Box 880, Framingham, Mass. 01701.*

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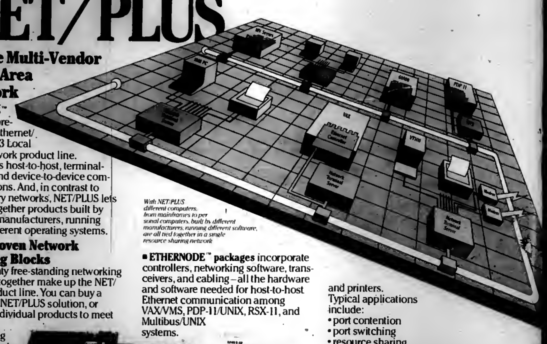

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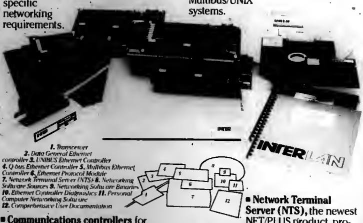

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